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PREDICTED TRAPPED PARTICLE RADIATION LEVELS FOR TIROS-N

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PREDICTED TRAPPED PARTICLE RADIATION LEVELS FOR TIROS-N

A special study conducted
for the TIROS Project Office

by

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NASA-Goddard Space Flight Center
Space and Earth Sciences Directorate
National Space Science Data Center

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Goddard Space Flight Center
Greenbelt, Maryland

Foreword

Vehicle encountered electron and proton fluxes were calculated for a set of nominal TIROS-N trajectories with new computational methods and new electron environment models. Temporal variations in the electron data were considered and partially accounted for. Estimates of energetic solar proton fluxes are given for the lifetime of the satellite at selected integral energies from 10 to 100 Mev. Field strength calculations were performed with an extrapolated model on the basis of linear secular variation predictions. Orbital flux integration results are presented in graphical and tabular form; they are analyzed, explained, and discussed.

This study was performed in order to assist in the evaluation of design and specification criteria for the TIROS-N Spacecraft. The information contained in the present report supersedes all older data, especially the data released in the last TIROS/TOS/ITOS report of September 1971 (Stassinopoulos, 1971).

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Introduction

The planning for the TIROS-N satellite provides for a circular flightpath at about 1680 kilometers altitude and at about 77 degree retrograde inclination. The trajectory is almost identical to the 900 n.m. orbit discussed in a previous report (Stassinopoulos, 1971). All comments and remarks made in that report in relation to the transverse motion of the spacecraft through the terrestrial radiation belt, as well as the prograde versus retrograde considerations, apply also to the present case. The only minor difference is the orbit period, which now is 2 hours even (a consequence of the slightly increased altitude). The effects of this even period on the environment sampling process are discussed in detail in part (I) of section "Results: Analysis and Discussion".

Two new environment models were used in the TIROS-N calculations : the AE5 by Teague and Vette (1972) for the inner zone electrons, and the AE4 by Singley and Vette (1971) for the outer zone electrons. Some observations on both models are in order.

The inner zone AE5 : this model is presently available only for the epoch October 1967, although additional epochs will be issued later. Since the model contains a Starfish residual component at some L values, it was necessary to insure that this component, which will not be present in the 1970ies, would not affect the calculations. The times at which the Starfish component has decayed to levels where it is masked by the natural electron fluxes has been determined by Teague and Stassinopoulos (1972) as a function of energy and L . Using these times and an exponential decay determined from experimental data (Stassinopoulos and Verzariu, 1971), this component was removed from the calculation.

In constructing the AE5 model, it was possible to infer a change of the quiet time inner zone flux levels as a function of the solar cycle. Since epoch October 1967 is more equivalent to the 1978-9 period than the October 1976 launch of TIROS-N, the actual fluxes may be somewhat lower than those calculated here because the latter epoch is closer to solar minimum, while the former epochs are near solar maximum. This will be indicated by restricting the use of the uncertainty factors attached to these results to division only, where the uncertainty is proportional to the time spent at a given L value and to the average expected variation in the intensities.

The outer zone AE4: this model too is presently available only for the epoch 1967,but a 1964 version is soon to be released. Again, the fluxes calculated with the 1967 AE4 for TIROS-N relate to solar maximum conditions and may be a some what higher than the actual fluxes expected around launch time, October 1976. As with the inner zone AE5, this will be reflected in the restrictive use of the uncertainty factors.

All comments, remarks, or references made for the TIROS/TOS/ITOS project in regards to proton fluxes, their models, spectra, calculations, and uncertainties, are still valid at this time and apply equally to the TIROS-N.

Appendix A contains pertinent information of units, field models, trajectory generation and conversion, etc.

Two new sections, Appendixes B and C, have been added to this report, relating to the enclosed tables and plots, explaining their format and describing their data.

A further addition to the output data and the reference material usually included in our reports is:

a) a projection of the satellite trajectory on a world map grid drawn in Miller cylindrical coordinates, where the start of each successive orbit (revolution) is sequentially numbered,

b) a trace of the flight path in magnetic B-L space after conversion from geocentric geographic (geodetic system) to geocentric geomagnetic (B-L system) coordinates,

c) computer produced exposure analysis table,

d) computer produced time account table.

Novel features in our old tables, besides improved headlines and labels, are:

a) new constant L-band intervals on the first output table, extending now to L=8.2,

b) L-band tables also generated for protons,

c) complete description of low energy protons included as a standard procedure in all studies,

d) spectral distribution given also in average orbit-integrated instantaneous fluxes.

At this point we should emphasize that our calculations are only approximations due to the large uncertainties in future flux levels; as always, we strongly recommend that all persons receiving parts of this report be advised about this uncertainty (see last paragraph of Appendix A).

A special addition to this report is the evaluation of solar proton fluxes for a high inclination, near earth satellite. Since these particles are effectively cut-off by the magnetosphere, only high latitude positions (north and south) contribute to their incidence. The TIROS-N trajectory is substantially affected.

Finally, an explanation regarding the attribute "standard", frequently used in the reformatted OFI (Orbital Flux Integration) Study Reports. The term is applied as a modifier to parameters, constants, or variables in order to indicate or refer to some specific value of these quantities a value that had been used without change over extended periods of time. Although override possibilities do exist in the OFI system, a routinely submitted production run will, by default option, always use these "standard" values. The term is also used in reference to established forms, style, processes, or procedures, as for example, "standard tables", "standard plots", "standard production runs", etc. A list of some quantities, values, or expressions modified by "standard" is given in Table 1.

Results: Analysis and Discussion

The outcome of our calculations is summarized in Tables 2 to 11, which are all computer produced; they include some new additions as well as some expanded or improved versions of previously routinely issued standard tables. The tables are arranged in three sections consisting of three tables each, one for low energy protons, one for high energy protons, and one for electrons. The set is completed by the fourth section consisting of a single table, pertaining to the entire mission.

The first section is composed of the L-band tables, the second of the Spectral Distribution and Exposure Index tables, and the third of the tables of Peaks. The last table consists of two parts: the "Exposure Analysis" summary and the "Time Account" breakdown. See Appendix B for a thorough explanation of the tables and a detailed description of their data. Figure 1 is a guide to the table arrangement as produced for a single trajectory by a standard production run of our Orbital Flux Integration (OFI) program UNIFLUX.

Some of the tabulated data is computer plotted in Figures 2 to 12. The plots are identical to those issued in past studies; their number only has been increased by including the low energy protons. As with the tables, the plots are arranged in four sections, where each section pertains to one specific type of plot. Again, all sections except the last contain three similar plots: one for each type of particle considered.

The first section of plots is composed of Time and Flux Histograms, the second of Spectral Profiles, and the third of Peaks per Orbit. The fourth section pertains to flight path data and should contain two plots; one of World Map Grid Projections, and one of B-L Space Tracings. Appendix C describes and explains the plots. Figure 2A is a guide to plot arrangement as produced for a single trajectory by a standard production run.

I. Trajectory Data

See Figure 11 for World Map Projections and Figure 12 for B-1 Space Tracings.

The relative orbit period determines the nodal precession of the trajectory. For circular flight paths the period is a simple function of geocentric distance. At the altitude proposed for the TIROS-N, the period is just about 2 hours with a corresponding precession of 30 degrees approximately. This amounts to twelve complete orbits for a twenty-four hour fligh-time duration. Now in the case of circular trajectories with large inclinations, the possibility exists that, when successive orbits lie more than 20 degrees apart, the simulated flight path may be "skipping" some high intensity regions of the radiation belts. Normally, this condition can be remedied by extending the flight time to 48, 72, or 96 hours, whereby a denser sampling of the ambient environment is insured. However, this does not work for the TIROS-N because the orbits of every subsequent day will pass through exactly the same positions as before, retracing identically the previous twelve orbits, on account of the period being an exact divisor of 24.

To improve the sampling coverage for this spacecraft, an additional 24-hour trajectory was generated but with an initial injection position displaced longitudinally by 15 degrees from the first one. Together the two trajectories provided an adequate sampling density to satisfy all TIROS-N mission requirements.

The world map projection of the flight path is plotted for ten revolutions of one trajectory only. The orbit numbers appear at the starting point of each revolution.

On the B-L graph, five orbits are plotted forming the depicted pattern. Each crosses the magnetic equator twice at the positions where the curves tuch the equatorial line. The tranverse motion is strikingly displayed. The spreading (displacement) of the traces is the effect of the nodal precession.

II. Spectral Profiles:

For tabulated data consult Tables 5-7.

For plotted data consult Figures 5-7.

The integral spectra presented in this report are orbit integrated, statistically averaged, trapped particle spectra, characteristic of the specific trajectory that produced them.

It is advisable to ignore the extrapolation from 4 Mev down to 3 Mev for the high energy proton fluxes (AP6). These values appear excessive and should be replaced with corresponding fluxes from the low evergy model (AP5).

Noteworthy are the electron spectra obtained from the new environment models AE5 and AE4, especially with regards to the steep fall-off to zero flux for $E \geq 4.5$ Mev. The apparent cutoff at about 5. Mev is probably due to the complete removal of the Starfish artificials, assuming no naturals exist with energies $E \geq 5.0$ Mev.

III. Peaks per Orbit:

Tabulated data is contained in Tables 8-10.

Plotted data is shown in Figures 8-10.

The absolute peaks presented in this report have been obtained for standard OFI (Orbital Flux Integration) energies: $E > .1$ Mev for low energy protons, $E > 5.$ Mev for high energy protons, and $E > .5$ Mev for electrons.

Evidently the peak contours follow a periodic pattern based on the daily cycle of 12 revolutions (See: "I. Trajectory Data" for more detail). Since the investigated trajectories are circular, no major changes are expected, assuming stable orbits and no atmospheric drag effects.

Energetic Solar Proton Fluxes

Good measurements of solar cycle 20 interplanetary cosmic ray fluxes at about 1 A.U. are now available. These interplanetary particles are also observed over the high latitude polar cap regions. However, at other latitudes the geomagnetic field effectively shields the earth from some of these cosmic rays by deflecting the lower energy particles, while only particles with increasingly higher energy penetrate to lower latitudes. Figure 13 shows the cut-off latitude of cosmic rays as a function of energy, between 10 and 100 Mev.

In order to consider the effect of geomagnetic shielding from cosmic rays on the TIROS-N spacecraft, the total time spent by the vehicle at latitudes greater than the cut-off values for the selected energies was calculated for the lifetime of the satellite. Experimentally determined low energy cosmic ray fluxes from which the galactic background had been subtracted were then used to obtain vehicle encountered solar proton intensities. Specifically, event-integrated solar proton fluxes given by J.H. King (letter to Distribution, September 29, 1972) for the August 4, 1972 event with energies $E > 10$ Mev, $E > 30$ Mev, and $E > 60$ Mev, were used to obtain intermediate spectral values at 20, 40, 50, and 100 Mev by fitting a curve through these three points, see Figure 13a.

The event of August 4-7, 1972, was the largest recorded so far in solar cycles 19 and 20, exceeding at the time of this writing the accumulative total of all other events in cycle 20 by about a factor of 2 for the $E > 10$ Mev protons and by a factor of 4 for the $E > 30$ and $E > 60$ Mev particles. Considering that we are approaching solar minimum again and that the probability of other large events is relatively low, we have used the fluxes observed during the August 1972 event as a basis to predict the cycle 21 fluxes, assuming that:

a) the sum total of all other events in the entire cycle 20, that is, until its end in 1974, will not exceed the August event, and

b) the fluxes were evenly accumulated over a 7 year period within the solar cycle, constituting a broad plateau from year 1966 to 1972, inclusive.

Based on the assumption (b) above, we derived a mean annual solar proton flux for the energies under consideration. In other words, we determined the flux that would have been accumulated by a satellite exposed to interplanetary solar protons continuously for the duration of one year, at 1 A.U., outside the magnetosphere.

These annual intensities were then applied to the next solar cycle, number 21, to predict vehicle encountered solar proton fluxes for the years 1976 to 1982.

Finally, the ratio of total exposure duration to entire mission duration was computed for each energy level, and a fraction of the predicted annual fluxes equal to that ratio was then determined as the estimated TIROS-N solar proton fluxes per one year of mission time. For a two year lifespan, these values would have to be doubled, of course. Figure 14 shows the omnidirectional orbit integrated spectral profile of the solar proton fluxes in units of particles per square centimeter per one year of mission duration. The uncertainty in the data is about a factor of 2-3 on the average.

Application of Predicted Radiation Levels to other TIROS Missions

The planning for the TIROS project includes several missions with proposed tentative launch dates in the years 1976,1977,1978, and 1980. The present radiation study was conducted for the first of these missions, the TIROS-N, scheduled for launch sometime in 1976. Since subsequent missions will have similar orbital configurations, the results of this investigation may be applied to these later missions also, provided the effects of time on the fluxes are taken into account, if and where necessary, and corresponding adjustments are made to either the intensity levels or the uncertainty factors. We will discuss these adjustments in the following paragraphs.

I. Trapped Protons: for time being and until newer or better proton models become available, the fluxes contained in this report may be used without change or adjustment for any later epoch since the proton environment does not display significant temporal variations.

II. Trapped Electrons: The use of the given electron results for a 1977 or 1978 mission (at about solar maximum) is quite appropriate, considering that the calculated fluxes pertain to a solar maximum epoch anyway (hence the restricted use of the uncertainty factor discussed on pages 2 and A-3). The only adjustment necessary would be to restore the multiplicative action of the uncertainty factor in order to obtain a suitable upper limit for the fluxes. Eventually a solar minimum version of the electron models will be available, which may make new calculations for that epoch desirable. The 1980 mission is about equivalent to the 1977 one, in terms of solar cycle position, because of the rapid three year rise from minimum to maximum and the slow eight year fall to minimum again.

III. Solar Protons: Since we have not taken into account the frequency or magnitude of solar events during the two extreme epochs in the solar cycle, but instead we have assumed that the sum-total fluxes used in this report were accumulated by an even distribution of events with an average (constant) magnitude of intensity , no differentiation between solar maximum and minimum is feasible. Therefore, the given predictions should be applied to all TIROS missions.

References

Cain, J. C., and S. J. Cain, "Derivation of the International Geomagnetic Reference Field (IGRF 10/68)", NASA Technical Note TN D-6237, August 1971.

Hassit, A., and C. E. McIlwain, "Computer Programs for the Computation of B and L (May 1966)", Data User's Note NSSDC 67-27, National Space Science Data Center, Greenbelt, Maryland, March 1967.

King, J. H., Models of the Trapped Radiation Environment, Volume IV: Low Energy Protons, NASA SP-3024, 1967.

King, J.H. ,"Study of Mutual Consistency of IMP-4 Solar Proton Data", NSSDC 72-14, National Space Science Data Center, Greenbelt, Maryland, October 1972.

Lavine, J. P., and J. I, Vette, Models of the Trapped Radiation Environment, Volume V: Inner Belt Protons, NASA SP-3024, 1969.

Lavine, J. P., and J. I. Vette, Models of the Trapped Radiation Environment, Volume VI: High Energy Protons, NASA SP-3024, 1970.

Singley, G. W., and J. I. Vette, "A Model Environment for Outer Zone Electrons", NSSDC 72-13, National Space Science Data Center, Greenbelt, Maryland, July 1972.

Stassinopoulos, E. G., and P. Verzariu, "General Formula for Decay Lifetimes of Starfish Electrons", J.Geophys.Res., 76, 1841-1844, 1971.

Stassinopoulos, E. G., and G. D. Mead, "ALLMAG, GDALMG, LINTRA: Computer Programs for Geomagnetic Field and Field-Line Calculations", NSSDC 72-12, National Space Science Data Center, Greenbelt, Maryland, February 1972.

Stassinopoulos, E. G., "Van Allen Belt Radiation on TIROS/TOS/ITOS Spacecrafts ", NASA-GSFC Report X-641-71-413, March 1972.

Teague, M. J., and E. G. Stassinopoulos, "The Limits for the Decay of Starfish Electrons", AGU-Transactions, 53, 496, 1972.

Teague, M. J., and J. I. Vette, "The Inner Zone Electron Model AE-5", NSSDC 72-10, National Space Science Data Center, Greenbelt, Maryland, September 1972.

APPENDIX A

General Background Information

For the specified TIROS-N trajectory, an orbit tape was generated with the standard integration stepsize of one minute, and for a 24 hour flighttime. Since the period, which determines the rate of flight path precession, is exactly 2 hours, special consideration had to be given to the TIROS-N orbit, to provide sufficient coverage. (For more detail, see: Results, I. Trajectory Data.) The following circular trajectories were thus produced:

Alt(km)	Incl.	Injection Position
1680	77°	7°W 0°N
''	''	22°W 0°N

The orbits were subsequently converted from geocentric polar into magnetic B-L coordinates with McIlwain's INVAR Program of 1965 (Hassit and McIlwain, 1967) and with the field routine ALLMAG by Stassinopoulos and Mead (1972), utilizing the IGRF(1965) geomagnetic field model by Cain and Cain (1971), calculated for the epoch 1970.0.

Orbital flux integrations were performed with Vette's current models of the environment, the new AE4-AE5 for outer and inner zone electrons, the AP6-AP7 for high energy protons, and the AP5 for low energy protons. All are static models which do not consider temporal variations; this includes the new electron models, at least as far as the present calculations are concerned. See text for further details on this matter.

The documents that describe these models are listed below:

Model	Reference
AE4	Singley and Vette, 1972
AE5	Teague and Vette, 1972
AP5	King, 1967
AP6	Lavine and Vette, 1969
AP7	Lavine and Vette, 1970

The results, relating to the omnidirectional, vehicle encountered, integral, trapped particle fluxes, are presented in graphical and tabular form with the following unit conventions:

1. Daily averages : total trajectory integrated flux averaged into particles/cm^2 day,
2. Average instantaneous : time integrated average, characteristic of the orbit, in particles/cm^2 sec,
3. Totals per orbit non-averaged, single-orbit integrated flux in particles/cm^2 orbit, and
4. Peaks per orbit highest orbit-encountered instantaneous flux in particles/cm^2 sec,

where one orbit = one revolution.

Please note: we wish to emphasize the fact that the data presented in this report are only approximations. We do not believe the results to be any better than a factor of 2 for the protons and a factor of 3 for the electrons. It is advisable to inform all potential users about this uncertainty in the data.

Please, also note that because the electrons have been calculated with a model describing the environment at solar maximum, the obtained fluxes are an overestimate for the first TIROS mission in 1976 by about a factor of 2 (see page 2 for more comments). Therefore, for the TIROS-N the electron results should be taken as an upper limit and the uncertainty factor should be applied only in its reducing capacity (divisor). For information regarding the use of these radiation levels for subsequent TIROS missions in later years, consult page 11.

APPENDIX B

Description of Tables

a) The L-band Table:

The table contains 36 L-bands L_i of equal size, covering the range from L - 1.0 to L - 8.2 earth radii in constant increments of .2 earth radii. For the L-intervals determined in this way, orbital spectral functions

$$N(>E,E_N;L_i) = \left[\sum_k J_k(>E;B)\right]_{L_i} \Big/ \left[\sum_k J_k(>E_N;B)\right]_{L_i} \qquad \begin{matrix} i=1,36 \\ L_i: L_i < L \leq L_{i+1} \end{matrix} \tag{1}$$

are obtained at nine arbitrary energy levels such that the integral spectrum is equal to 1 for $E = E_N$, where E_N was taken to be .1, 5., and .5 Mev for low energy protons, the high energy protons, and the electrons, respectively. The notation L_i is used to indicate the L-band from L_i to L_{i+1}, while $J(>E;B)$ is the integral, omnidirectional flux yielded by the environment model used in the calculation. The spectral functions N are evaluated for the total flight time simulated in the study, where the summing index k selects all trajectory points lying in each L_i.

The corresponding orbital distribution functions, representing fluxes above energy E_N, are given by

$$F(E;L_i) = \Delta t\left[\sum_k J_k(>E;B)\right]_{L_i} \tag{2}$$

where Δt is the constant time increment of orbit integration, whose standard value is 60 seconds. The distribution functions are fluxes accumulated in their respective L_i bands over the total flight period considered.

The orbital distribution functions are listed on the table at the bottom of each L-interval and are labeled "NORMFLUX". The nine integral energy levels selected for the low and high energy protons and for electrons are given below in units of "Mev" for all particles:

Protons		Electrons
Low	High	
.1*	3.	.0
.5	5.	.5*
.9	10.	1.0
1.1	15.	1.5
1.5	20.	2.0
2.0	25.	2.5
2.5	30.	3.0
3.0	50.	4.0
3.5	100.	5.0

where the normalization energy is indicated by a star (*).

b) <u>The Spectral Distribution and Exposure Index Table</u>:

This table has three parts:

I. The spectrum $\Psi_j(\Delta E)$ given in % for energy intervals that correspond to the energy levels of the previously discussed table (L-bands), with two special columns showing the total orbit integrated flux for these energy intervals averaged into instantaneous I_j^S and daily I_j^D intensities

$$\Psi_j(\Delta E) = 100 \frac{I_j^D(\Delta E)}{F(>E_1)} \qquad j=1,9 \tag{3}$$

where

$$F(>E_1) = C \sum_{k=1}^{k_0} J_k(>E_1;B,L)\Delta t \tag{4}$$

$$I_j^D(\Delta E) = C \sum_{k=1}^{k_0} \Delta t \left\{ J_k(>E_j;B,L) - J_k(>E_{j+1};B,L) \right\} \tag{5}$$

$$I_j^S(\Delta E) = I_j^D(\Delta E)/86400 \tag{6}$$

$$C = \frac{24}{T} \quad , \quad T = k_0 \Delta t \qquad i=1,36$$

and where k_0 is the upper limit of k. It is equal to the total number of time increments considered in the study.

II. The composite orbit spectrum for integral energies, giving the total vehicle encountered fluxes averaged into daily $S^D(>E_j)$ and instantaneous $S^S(>E_j)$ intensities for 15 discrete energy levels:

$$S^D(>E_j) = c\Delta t \sum_{m=0}^{T} J_m(>E_j) \qquad j=1,15 \tag{7}$$

$$S^S(>E_j) = S^D(>E_j)/86400 \tag{8}$$

where the summation is performed for the entire simulated mission duration T and includes all fluxes with energies greater than E_j.

III. The exposure index, given (for the normalization energy used in the L-band table) at nine successive intensity ranges R_n one order of magnitude apart, in terms of exposure duration $\tau(R_n)$, converted to hours, and total number of particles $\phi(>E_N;R_n)$ accumulated while in that intensity range. The notation R_n is used to indicate the intensity range from r_n to r_{n+1}:

$$\phi(>E_N;R_n) = \tau(R_n)\ \theta(>E_N;R_n) \qquad \begin{matrix} n=1,9 \\ R_n \equiv r_n < r \le r_{n+1} \end{matrix} \tag{9}$$

$$\theta(>E_N;R_n) = \left[\sum_{\ell} J(>E_N;r)\right]_{R_n} \Big/ \zeta_n \tag{10}$$

$$\tau(R_n) = \Delta t\ \zeta_n \tag{11}$$

where ζ_n is the upper limit of ℓ in each R_n.

c) The Table of Peaks:

In this table, the absolute instantaneous peak flux encountered during each successive orbit (revolution) is listed for the indicated energy range. There are nine columns on this table. Column 1 is an orbit counting device, based on the period of the orbit when the trajectory lies in the equatorial plane and is circular, on the physical perigee in all elliptical cases, and on the equatorial crossing for circular inclined trajectories. Column 2 gives the peak flux. Columns 3, 4, and 5 indicate the spacecraft position in geocentric coordinates at which the peak was encountered, while columns 6, 7, and 8 determine respectively the time and the magnetic B-L coordinates for this event. It should be noted that all simulated flight paths for the purpose of orbital radiation studies start at $t_0 = 0$ hours. Finally, the last column indicates the total flux encountered during that particular orbit. It is advisable to disregard the last line on this table because many times that orbit is incomplete and the fluxes or positions shown do not correspond to true peaks.

d) The Exposure Analysis Summary:

The summary is contained in the left half of this last table of each set as a semi-independent and separate table. It indicates what percent of its total lifetime T the satellite spends in "flux free" regions of space, what percent of T in "high intensity" regions, and while in the latter, what percent of its total daily flux it accumulates.

In the context of this study, the term "flux free" applies to all regions of space where trapped particle fluxes are less than one proton or electron per square centimeter per second, having energies $E > .1$, $E > 5.$, and $E > .5$ Mev for the low energy protons, the high energy protons, and the electrons, respectively; by definition, this includes all regions outside the radiation belts. The concept of "trapped particle fluxes" is meant to include stably trapped, pseudo-trapped, and transient fluxes, as long as they are part of or contained in the environment models used and, in the case of transients or pseudos, their sources are considered powerful enough to supply them in a substantial and ever present way.

Similarly, we define as "high intensity" those regions of space where the instantaneous, integral, omnidirectional, trapped-particle flux is greater than 10^3 protons with energies E > .1 or E > 5. Mev, and greater than 10^5 electrons with energies E > .5 Mev.

The values given in this table are statistical averages, obtained over extended intervals of mission time. However, they may vary significantly from one orbit to the next, when individual orbits are considered.

e) The Time Account Breakdown:

The breakdown of orbit time is given in the right half of the last table of every set, in the same semi-independent form as the summary. The table shows the total lifetime spent by the vehicle in the inner zone T^i ($1.0 < L \leq 2.5$) and the outer zone T^o ($2.5 < L \leq 7.0$) of the trapped particle radiation belt, and also the percent duration spent outside that region ($L > 7.0$), which is denoted by T^e (T-external), such that for any mission

$$T = T^i + T^o + T^e = 100\%.$$

The confinement of the outer zone within the boundary of the L = 7.0 volume is arbitrary and has no physical meaning. It is intended only as a simplification to facilitate our calculations. The region considered "external" (L = 7.0) in this study is still partially a domain of the outer zone, at least as far out as L = 11.0 earth radii, according to the latest electron models (Singley and Vette, 1972).

A last item on this table: the inner zone time T^i may be subdivided into two parts: the percentage of time spent outside the region $(1.0 < L \leq 1.1)$ and inside the region $(1.1 < L \leq 2.5)$.

APPENDIX C

Description of Plots

a) The Time and Flux Histogram:

This plot shows two curves superimposed on the same graph, namely, one each for the variables "time" and "flux". Both are given as functions of the parameter L (earth radii) within the range 1 - L - 7, on a semi-log scale. The plot depicts: (1) by a plain curve the characteristic trajectory intensities as obtained from the orbital integration process in terms of averaged, instantaneous, integral particle fluxes above a given energy, over constant L-bands of .1 earth radius width, and (2) by a contour marked with symbols the percent of total lifetime (%T) spent in each L-interval. The logarithmic ordinate relates to the time-flux variables. The printed numbers are powers of 10 and pertain to the fluxes; the scale values for the time curve are given in the upper part of the ordinate label: from 10^{-3} to 10^{2} percent of T. The type of particles, their integral energy, and the units, are all given in the lower part of the label. The label on top of the graph lists some useful information about the trajectory.

b) The Spectral Profile:

A graphical presentation of the final spectral distribution, obtained from the orbital integration process. The plot is a semi-log graph, where the abscissa is a linear energy scale for integral particle energies

E_0 in Mev, and the ordinate is a logarithmic scale for the orbit integrated fluxes, given in daily averages for energies greater than E_0; the printed scale values are powers of 10.

c) Peaks per Orbit:

Here the absolute peak intensities, encountered per period, are plotted for the duration of the total flight time considered (1 period = 1 revolution = 1 orbit). The logarithmic ordinate relates to instantaneous particle fluxes of the environment at the indicated energy threshold, while the abscissa is a linear orbit enumeration.

d) World Map Grid Projection of Orbits:

The trajectory is plotted for several revolutions on a global map produced by a Miller Cylindrical Projection. The contours of the continents have been omitted for clarity. The positions of either equatorial crossing, of physical perigee, or of period commencement are indicated by numbers identifying the orbits shown in this graph. For all trajectories, the distance between successive sequential numbers is a measure of the orbit precession.

e) B-L Trace of Orbits:

This plot shows a trace of the trajectory in B-L space on a semi-log scale. Several orbits are usually depicted, each identified by its sequential number. The magnetic equator is entered on all plots. The logarithmic ordinate relates to the field strength B in gauss; the printed values are exponents of 10. L is given in earth radii on the linear abscissa.

TABLE 1

Partial Listing of
Parameters, Constants, Variables, or Expressions
designated as "standard" in the text

1. Standard Tables: set of tables as listed in Figure 2, in the regular format described in Appendix B.

2. Standard Plots: set of plots as listed in Figure 2A, in the regular format described in Appendix C.

3. Standard Production Run: a production run processed on default options.

4. Standard Integration Stepsize: constant time increment of orbit integration: 1'(60").

5. Standard Energies: low energy protons E > .1 Mev, high energy protons E > 5. Mev, and electrons E > .5 Mev.

6. Standard Procedure: established procedure normally followed vs. procedure followed in special cases.

Table 2

** ORBITAL FLUX STUDY WITH COMPOSITE PARTICLE ENVIRONMENTS : VETTES AE4, AE5, AP1, AP5, AP6, AP7 **** PROCEDURE : UNIFLUX OF 1972 **
** ELECTRON FLUXES EXPONENTIALLY DECAYED TO 1972. 0 WITH LIFETIMES: E.G.STASSINOPOULOS&P.VERZARIU ** CUTOFF TIMES: **
** MAGNETIC COORDINATES B AND L COMPUTED BY INVARA OF 1972 WITH ALLMAG, MODEL 5: IGRF 1965.0 80-TERM 10/68 * TIME= 1972.0 **
** VEHICLE : TIROS-N 22 ** INCLINATION= 77DEG ** PERIGEE= 1680KM ** APOGEE= 1680KM ** B/L ORBIT TAPE: TD6943 ** PERIOD= 2.000 **

ELECTRONS

** SPECTRAL DISTRIBUTION - NORMALIZED BY FLUX OF ENERGY GREATER THAN .500 MEV **

L - BANDS (MAGNETIC SHELL PARAMETER IN EARTH RADII) L - BANDS

ENERGY LEVELS >(MEV)	*1.0-1.2*	*1.2-1.4*	*1.4-1.6*	*1.6-1.8*	*1.8-2.0*	*2.0-2.2*	*2.2-2.4*	*2.4-2.6*	*2.6-2.8*	*2.8-3.0*	*3.0-3.2*	*3.2-3.4*
.0	5.45E 00	9.93E 00	1.91E 01	9.60E 01	1.53E 02	2.81E 02	5.47E 02	2.92E 02	6.08E 01	2.42E 01	1.23E 01	1.33E 01
.500	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
1.00	5.23E-01	8.55E-02	1.87E-01	2.10E-01	6.81E-02	4.12E-02	4.30E-02	7.50E-02	1.84E-01	3.32E-01	3.67E-01	3.92E-01
1.50	3.36E-01	3.25E-02	9.71E-02	8.94E-02	1.67E-02	6.55E-03	5.84E-03	1.46E-02	6.83E-02	1.67E-01	1.80E-01	1.94E-01
2.00	1.60E-01	1.61E-02	5.52E-02	3.69E-02	4.79E-03	1.58E-03	1.09E-03	3.14E-03	2.84E-02	8.39E-02	8.80E-02	9.58E-02
2.50	4.88E-02	6.70E-03	2.38E-02	1.28E-02	1.29E-03	3.21E-04	1.35E-04	3.93E-04	7.63E-03	3.69E-02	3.80E-02	4.17E-02
3.00	1.33E-02	2.38E-03	7.63E-03	3.83E-03	2.97E-04	3.26E-05	0.0	0.0	6.95E-04	1.18E-02	1.40E-02	1.52E-02
4.00	5.46E-05	2.19E-05	6.78E-05	7.55E-05	2.69E-05	0.0	0.0	0.0	0.0	3.68E-04	3.89E-04	4.18E-04
5.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NORMFLUX=	2.93E 07	5.49E 10	2.07E 10	1.66E 09	4.89E 03	1.52E 08	3.68E 07	1.41E 07	5.00E 06	1.93E 07	2.02E 08	2.56E 08

L - BANDS (MAGNETIC SHELL PARAMETER IN EARTH RADII) L - BANDS

ENERGY LEVELS >(MEV)	*3.4-3.6*	*3.6-3.8*	*3.8-4.0*	*4.0-4.2*	*4.2-4.4*	*4.4-4.6*	*4.6-4.8*	*4.8-5.0*	*5.0-5.2*	*5.2-5.4*	*5.4-5.6*	*5.6-5.8*
.0	1.44E 01	1.23E 01	8.91E 00	6.93E 00	6.80E 00	6.70E 00	6.94E 00	7.21E 00	7.43E 00	7.59E 00	7.69E 00	7.64E 00
.500	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
1.00	3.95E-01	3.86E-01	3.66E-01	3.55E-01	3.55E-01	3.54E-01	3.45E-01	3.37E-01	3.30E-01	3.22E-01	3.15E-01	2.81E-01
1.50	1.97E-01	1.93E-01	1.72E-01	1.50E-01	1.42E-01	1.33E-01	1.27E-01	1.21E-01	1.15E-01	1.06E-01	1.00E-01	8.59E-02
2.00	9.87E-02	9.63E-02	8.07E-02	6.36E-02	5.71E-02	5.00E-02	4.66E-02	4.36E-02	3.98E-02	3.51E-02	3.19E-02	2.63E-02
2.50	4.51E-02	4.70E-02	4.03E-02	2.83E-02	2.42E-02	1.99E-02	1.74E-02	1.54E-02	1.31E-02	1.06E-02	9.05E-03	7.19E-03
3.00	1.78E-02	1.98E-02	1.81E-02	1.25E-02	9.78E-03	7.21E-03	5.65E-03	4.51E-03	3.53E-03	2.69E-03	2.22E-03	1.78E-03
4.00	5.42E-04	6.51E-04	6.10E-04	3.91E-04	2.75E-04	1.81E-04	1.37E-04	1.07E-04	8.09E-05	5.80E-05	4.56E-05	3.01E-05
5.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NORMFLUX=	3.78E 08	3.36E 08	3.45E 08	6.73E 08	3.54E 08	3.64E 08	3.12E 08	3.25E 08	1.88E 08	1.95E 08	1.17E 08	1.43E 08

L - BANDS (MAGNETIC SHELL PARAMETER IN EARTH RADII) L - BANDS

ENERGY LEVELS >(MEV)	*5.8-6.0*	*6.0-6.2*	*6.2-6.4*	*6.4-6.6*	*6.6-6.8*	*6.8-7.0*	*7.0-7.2*	*7.2-7.4*	*7.4-7.6*	*7.6-7.8*	*7.8-8.0*	*8.0-8.2*
.0	7.56E 00	8.19E 00	9.43E 00	1.14E 01	1.31E 01	1.62E 01	2.05E 01	2.81E 01	3.62E 01	6.29E 01	1.11E 02	2.71E 03
.500	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
1.00	2.53E-01	2.39E-01	2.36E-01	2.32E-01	2.14E-01	1.71E-01	1.47E-01	1.30E-01	1.18E-01	1.04E-01	9.15E-02	5.73E-02
1.50	7.52E-02	6.65E-02	6.49E-02	6.05E-02	5.32E-02	3.88E-02	3.14E-02	2.68E-02	2.37E-02	2.00E-02	1.69E-02	7.47E-03
2.00	2.23E-02	1.96E-02	1.79E-02	1.58E-02	1.32E-02	8.79E-03	6.72E-03	5.50E-03	4.75E-03	3.85E-03	3.12E-03	1.15E-03
2.50	6.00E-03	5.10E-03	4.44E-03	3.71E-03	3.00E-03	1.90E-03	1.41E-03	1.12E-03	9.52E-04	6.96E-04	5.04E-04	4.56E-05
3.00	1.52E-03	1.24E-03	9.84E-04	7.35E-04	5.80E-04	3.82E-04	2.86E-04	2.17E-04	1.83E-04	6.91E-05	0.0	0.0
4.00	2.17E-05	1.17E-05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NORMFLUX=	1.34E 08	9.47E 07	4.38E 07	2.80E 07	2.03E 07	1.43E 07	1.97E 07	1.04E 07	1.66E 06	4.31E 06	1.93E 06	1.78E 06

Table 3

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****************************************************************************************************************************
** ORBITAL FLUX STUDY WITH COMPOSITE PARTICLE ENVIRONMENTS : VETTES AE4, AE5, AP1, AP5, AP6, AP7 **** PROCEDURE : UNIFLUX OF 1972 **
** ELECTRON FLUXES EXPONENTIALLY DECAYED TO 1972. 0 WITH LIFETIMES: E.G.STASSINOPOULOS&P.VERZARIU ** CUTOFF TIMES:               **
** MAGNETIC COORDINATES B AND L COMPUTED BY INVARA OF 1972 WITH ALLMAG, MODEL  5:     IGRF 1965.0 80-TERM 10/68    * TIME= 1972.0 **
** VEHICLE :   TIROS-N 22 ** INCLINATION= 77DEG ** PERIGEE= 1680KM ** APOGEE=  1680KM ** B/L ORBIT TAPE: TD6943 ** PERIOD=  2.000 **
****************************************************************************************************************************
                   **************************  HIGH ENERGY PROTONS   ******************************
                   ** SPECTRAL DISTRIBUTION - NORMALIZED BY FLUX OF ENERGY GREATER THAN 5.00 MEV **
                   ********************************************************************************
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L - BANDS (MAGNETIC SHELL PARAMETER IN EARTH RADII) L - BANDS

ENERGY LEVELS >(MEV)	*1.0-1.2*	*1.2-1.4*	*1.4-1.6*	*1.6-1.8*	*1.8-2.0*	*2.0-2.2*	*2.2-2.4*	*2.4-2.6*	*2.6-2.8*	*2.8-3.0*	*3.0-3.2*	*3.2-3.4*
3.00	2.62E 00	1.45E 00	1.69E 00	1.72E 00	1.90E 00	4.14E 00	8.18E 00	2.28E 01	2.52E 02	9.24E 03	5.72E 04	1.25E 05
5.00	1.00E 00	1.00F 00	1.00F 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
10.0	7.34E-01	6.03E-01	5.19E-01	3.97E-01	3.11E-01	2.87E-01	2.62E-01	1.88E-01	1.47E-01	1.03E-01	2.42E-02	0.0
15.0	5.45E-01	3.61F-01	2.70F-01	1.56E-01	9.31E-02	8.09E-02	6.87E-02	3.58E-02	2.17E-02	4.29E-03	0.0	0.0
20.0	4.41E-01	2.45E-01	1.69E-01	7.83E-02	3.68E-02	2.94E-02	2.24E-02	8.38E-03	3.20E-03	0.0	0.0	0.0
25.0	4.34E-01	2.33E-01	1.62E-01	7.26E-02	3.27E-02	2.49E-02	1.79E-02	6.07E-03	1.58E-03	0.0	0.0	0.0
30.0	4.19E-01	2.06E-01	1.45E-01	6.02E-02	2.42E-02	1.65E-02	1.04E-02	2.97E-03	2.85E-04	0.0	0.0	0.0
50.0	4.04F-01	1.83E-01	1.31E-01	5.00E-02	1.80E-02	1.09E-02	6.03E-03	1.57E-03	0.0	0.0	0.0	0.0
100.	3.10E-01	9.59E-02	7.09F-02	1.81E-02	3.70E-03	1.16E-03	1.97E-04	0.0	0.0	0.0	0.0	0.0
NORMFLUX=	2.27E 06	6.81E 08	3.44E 08	1.70E 08	1.12E 08	5.70E 07	1.99E 07	9.49E 06	1.83E 06	9.60E 04	2.01E 04	7.03E 03

L - BANDS (MAGNETIC SHELL PARAMETER IN EARTH RADII) L - BANDS

ENERGY LEVELS >(MEV)	*3.4-3.6*	*3.6-3.8*	*3.8-4.0*	*4.0-4.2*	*4.2-4.4*	*4.4-4.6*	*4.6-4.8*	*4.8-5.0*	*5.0-5.2*	*5.2-5.4*	*5.4-5.6*	*5.6-5.8*
3.00	5.79E 05	9.54E 06	5.01E 06	6.59E 05	4.37E 04	1.86E 04	9.87E 03	6.55E 03	2.84E 03	2.53E 03	1.40E 03	1.64E 03
5.00	1.00F 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NORMFLUX=	1.71E 03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

L - BANDS (MAGNETIC SHELL PARAMETER IN EARTH RADII) L - BANDS

ENERGY LEVELS >(MEV)	*5.8-6.0*	*6.0-6.2*	*6.2-6.4*	*6.4-6.6*	*6.6-6.8*	*6.8-7.0*	*7.0-7.2*	*7.2-7.4*	*7.4-7.6*	*7.6-7.8*	*7.8-8.0*	*8.0-8.2*
3.00	1.49E 03	1.09E 03	5.39E 02	3.78E 02	2.47E 02	8.23E 01	3.90E 01	1.92E 00	0.0	0.0	0.0	0.0
5.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NORMFLUX=	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Correct Initial Position & Park 22° West   Table 4.

```
********************************************************************************************************************
** ORBITAL FLUX STUDY WITH COMPOSITE PARTICLE ENVIRONMENTS : VETTES AE4, AE5, AP1, AP5, AP6, AP7 **** PROCEDURE : UNIFLUX OF 1972 **
** ELECTRON FLUXES EXPONENTIALLY DECAYED TO 1972. 0 WITH LIFETIMES: E.G.STASSINOPOULOS&P.VERZARIU ** CUTOFF TIMES:              **
** MAGNETIC COORDINATES B AND L COMPUTED BY INVARA OF 1972 WITH ALLMAG, MODEL  5:     IGRF 1965.0 80-TERM 10/68    * TIME= 1972.0 **
** VEHICLE :    TIROS-N 22 ** INCLINATION= 77DEG ** PERIGEE= 1680KM ** APOGEE=  1680KM ** B/L ORBIT TAPE: TD6943 ** PERIOD= -2.000 **
********************************************************************************************************************
                         *************************   LOW  ENERGY PROTONS   ***************************
                         ** SPECTRAL DISTRIBUTION - NORMALIZED BY FLUX OF ENERGY GREATER THAN .100 MEV **
                         ****************************************************************************
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ENERGY LEVELS >(MEV)	L - B A N D S (M A G N E T I C S H E L L P A R A M E T E R I N E A R T H R A D I I) L - B A N D S											
	1.0-1.2	*1.2-1.4*	*1.4-1.6*	*1.6-1.8*	*1.8-2.0*	*2.0-2.2*	*2.2-2.4*	*2.4-2.6*	*2.6-2.8*	*2.8-3.0*	*3.0-3.2*	*3.2-3.4*
.100	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
.500	8.44E-01	8.34E-01	8.34E-01	8.34E-01	8.41E-01	7.86E-01	5.14E-01	4.24E-01	4.07E-01	3.72E-01	3.30E-01	3.04E-01
.900	7.28E-01	7.26E-01	7.23E-01	7.22E-01	7.30E-01	6.43E-01	3.03E-01	2.12E-01	1.82E-01	1.41E-01	1.09E-01	9.28E-02
1.10	6.94E-01	7.12E-01	7.04E-01	7.03E-01	7.07E-01	5.98E-01	2.72E-01	1.81E-01	1.36E-01	8.87E-02	6.30E-02	5.15E-02
1.50	6.30E-01	6.86E-01	6.68E-01	6.66E-01	6.62E-01	5.18E-01	2.20E-01	1.32E-01	7.68E-02	3.52E-02	2.10E-02	1.59E-02
2.00	5.59E-01	6.54E-01	6.26E-01	6.22E-01	6.11E-01	4.34E-01	1.69E-01	8.92E-02	3.83E-02	1.12E-02	5.34E-03	3.66E-03
2.50	4.95E-01	6.25E-01	5.86E-01	5.82E-01	5.65E-01	3.63E-01	1.30E-01	6.04E-02	1.94E-02	3.59E-03	1.36E-03	8.45E-04
3.00	4.39E-01	5.97E-01	5.49E-01	5.44E-01	5.22E-01	3.05E-01	1.00E-01	4.10E-02	1.00E-02	1.17E-03	3.47E-04	1.96E-04
3.50	3.90E-01	5.70E-01	5.15E-01	5.09E-01	4.83E-01	2.56E-01	7.76E-02	2.79E-02	5.26E-03	3.82E-04	8.85E-05	4.55E-05
NORMFLUX=	6.56E 06	1.25E 09	7.14E 08	3.56E 08	2.50E 08	2.65E 08	3.30E 08	4.99E 08	6.55E 08	7.58E 08	8.89E 08	6.62E 08

ENERGY LEVELS >(MEV)	L - B A N D S (M A G N E T I C S H E L L P A R A M E T E R I N E A R T H R A D I I) L - B A N D S											
	3.4-3.6	*3.6-3.8*	*3.8-4.0*	*4.0-4.2*	*4.2-4.4*	*4.4-4.6*	*4.6-4.8*	*4.8-5.0*	*5.0-5.2*	*5.2-5.4*	*5.4-5.6*	*5.6-5.8*
.100	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00
.500	2.61E-01	2.14E-01	1.32E-01	3.13E-02	9.44E-03	6.40E-03	5.31E-03	3.84E-03	3.66E-03	3.68E-03	3.65E-03	3.71E-03
.900	6.86E-02	4.63E-02	1.84E-02	1.23E-03	9.31E-05	4.11E-05	2.83E-05	1.48E-05	1.34E-05	1.35E-05	1.33E-05	1.37E-05
1.10	3.52E-02	2.16E-02	7.00E-03	2.60E-04	9.41E-05	3.30E-06	2.07E-06	8.56E-07	3.72E-07	8.98E-08	0.0	0.0
1.50	9.34E-03	4.72E-03	1.03E-03	1.28E-05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.00	1.79E-03	7.12E-04	9.66E-05	1.61E-07	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.50	3.48E-04	1.08E-04	9.19E-06	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.00	6.81E-05	1.65E-05	5.90E-07	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.50	1.35E-05	1.97E-06	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NORMFLUX=	7.69E 08	6.13E 08	7.55E 08	1.74E 09	1.53E 09	1.51E 09	1.27E 09	1.62E 09	8.40E 08	7.83E 08	4.54E 08	5.44E 08

ENERGY LEVELS >(MEV)	L - B A N D S (M A G N E T I C S H E L L P A R A M E T E R I N E A R T H R A D I I) L - B A N D S											
	5.8-6.0	*6.0-6.2*	*6.2-6.4*	*6.4-6.6*	*6.6-6.8*	*6.8-7.0*	*7.0-7.2*	*7.2-7.4*	*7.4-7.6*	*7.6-7.8*	*7.8-8.0*	*8.0-8.2*
.100	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	0.0	0.0	0.0	0.0
.500	3.63E-03	3.59E-03	4.03E-03	3.73E-03	4.11E-03	5.61E-03	7.66E-03	1.19E-02	0.0	0.0	0.0	0.0
.900	1.32E-05	1.29E-05	1.64E-05	1.39E-05	1.71E-05	2.91E-05	2.91E-05	0.0	0.0	0.0	0.0	0.0
1.10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NORMFLUX=	5.35E 08	4.12E 08	1.72E 08	1.44E 08	8.35E 07	1.97E 07	6.99E 06	3.54E 05	0.0	0.0	0.0	0.0

Table 5

** ORBITAL FLUX STUDY WITH COMPOSITE PARTICLE ENVIRONMENTS : VETTES AE4, AE5, AP1, AP5, AP6, AP7 **** PROCEDURE : UNIFLUX OF 1972 **
** ELECTRON FLUXES EXPONENTIALLY DECAYED TO 1972. 0 WITH LIFETIMES: E.G.STASSINOPOULOS&P.VERZARIU ** CUTOFF TIMES: **
** MAGNETIC COORDINATES B AND L COMPUTED BY INVARA OF 1972 WITH ALLMAG, MODEL 5: IGRF 1965.0 80-TERM 10/68 * TIME= 1972.0 **
** VEHICLE : TIROS-N 22 ** INCLINATION= 77DEG ** PERIGEE= 1680KM ** APOGEE= 1680KM ** B/L ORBIT TAPE: TD6943 ** PERIOD= 2.000 **

ELECTRONS

****** SPECTRUM IN PERCENT DELTA ENERGY ******

ENERGY RANGES (MEV)	AVERAGED TOTAL FLUX #/CM**2/SEC	AVERAGED TOTAL FLUX #/CM**2/DAY	SPECTRUM PER CENT
.0 -.500	1.397E 07	1.207E 12	93.591
.500-1.00	8.340E 05	7.206E 10	5.589
1.00-1.50	6.877E 04	5.941E 09	0.461
1.50-2.00	2.595E 04	2.242E 09	0.174
2.00-2.50	1.590E 04	1.374E 09	0.107
2.50-3.00	7.667E 03	6.624E 08	0.051
3.00-4.00	3.910E 03	3.379E 08	0.026
4.00-5.00	4.752E 01	4.106E 06	0.000
5.00-OVER	0.0	0.0	0.0
TOTAL	1.492E 07	1.289E 12	100.000

*** COMPOSITE ORBIT SPECTRUM ***

ENERGY LEVELS >(MEV)	AVERAGED INTEG.FLUX #/CM**2/SEC	AVERAGED INTEG.FLUX #/CM**2/DAY
.0	1.492E 07	1.289E 12
.250	3.228E 06	2.789E 11
.500	9.563E 05	8.262E 10
.750	2.630E 05	2.272E 10
1.00	1.222E 05	1.056E 10
1.25	8.199E 04	7.084E 09
1.50	5.348E 04	4.621E 09
1.75	4.003E 04	3.459E 09
2.00	2.753E 04	2.379E 09
2.50	1.162E 04	1.004E 09
3.00	3.958E 03	3.420E 08
3.50	4.851E 02	4.191E 07
4.00	4.752E 01	4.106E 06
4.50	9.562E-01	8.261E 04
5.00	0.0	0.0

* EXPOSURE INDEX-ENERGY >.500MEV *

INTENSITY RANGES #/CM**2/SEC	EXPOSURE DURATION (HOURS)	TOTAL # OF ACCUMULATED PARTICLES
ZERO FLUX	3.883	0.0
1.E0-1.E1	0.067	9.504E 02
1.E1-1.E2	0.133	1.521E 04
1.E2-1.E3	0.733	1.360E 06
1.E3-1.E4	2.450	4.126E 07
1.E4-1.E5	4.800	7.506E 08
1.E5-1.E6	7.667	9.162E 09
1.E6-1.E7	3.850	5.560E 10
1.E7-OVER	0.417	1.706E 10
TOTAL	24.000	8.263E 10

Table 6

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******************************************************************************************************************************************
** ORBITAL FLUX STUDY WITH COMPOSITE PARTICLE ENVIRONMENTS : VETTES AE4, AE5, AP1, AP5, AP6, AP7 **** PROCEDURE : UNIFLUX OF 1972 **
** ELECTRON FLUXES EXPONENTIALLY DECAYED TO 1972. 0 WITH LIFETIMES: E.G.STASSINOPOULOS&P.VERZARIU ** CUTOFF TIMES:                    **
** MAGNETIC COORDINATES B AND L COMPUTED BY INVARA OF 1972 WITH ALLMAG, MODEL  5:    IGRF 1965.0 80-TERM 10/68     * TIME= 1972.0 **
** VEHICLE :   TIROS-N 22 ** INCLINATION= 77DEG ** PERIGEE= 1680KM ** APOGEE=  1680KM ** B/L ORBIT TAPE: TD6943 ** PERIOD=  2.000 **
******************************************************************************************************************************************
                                          ************   HIGH ENERGY PROTONS   ************
                                          **********************************************
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****** SPECTRUM IN PERCENT DELTA ENERGY ******

ENERGY RANGES (MEV)	AVERAGED TOTAL FLUX #/CM**2/SEC	AVERAGED TOTAL FLUX #/CM**2/DAY	SPECTRUM PER CENT
3.00-5.00	7.617E 04	6.581E 09	82.481
5.00-10.0	7.879E 03	6.808E 08	8.532
10.0-15.0	3.858E 03	3.333E 08	4.178
15.0-20.0	1.598E 03	1.381E 08	1.731
20.0-25.0	1.416E 02	1.224E 07	0.153
25.0-30.0	3.195E 02	2.761E 07	0.346
30.0-50.0	2.768E 02	2.391E 07	0.300
50.0-100.	1.017E 03	8.785E 07	1.101
100.-OVER	1.088E 03	9.400E 07	1.178
TOTAL	9.235E 04	7.979E 09	100.000

*** COMPOSITE ORBIT SPECTRUM ***

ENERGY LEVELS >(MEV)	AVERAGED INTEG.FLUX #/CM**2/SEC	AVERAGED INTEG.FLUX #/CM**2/DAY
3.00	9.235E 04	7.979E 09
4.00	1.860E 04	1.607E 09
5.00	1.618E 04	1.398E 09
7.00	1.294E 04	1.118E 09
10.0	8.299E 03	7.170E 08
12.0	5.446E 03	4.705E 08
15.0	4.441E 03	3.837E 08
18.0	3.299E 03	2.850E 08
20.0	2.843E 03	2.456E 08
25.0	2.701E 03	2.334E 08
30.0	2.382E 03	2.058E 08
50.0	2.105E 03	1.819E 08
60.0	1.309E 03	1.131E 08
70.0	1.193E 03	1.030E 08
100.	1.088E 03	9.400E 07

* EXPOSURE INDEX-ENERGY >5.00MEV *

INTENSITY RANGES #/CM**2/SEC	EXPOSURE DURATION (HOURS)	TOTAL # OF ACCUMULATED PARTICLES
ZERO FLUX	9.083	0.0
1.E0-1.E1	0.967	1.670E 04
1.E1-1.E2	0.717	9.287E 04
1.E2-1.E3	0.750	1.579E 06
1.E3-1.E4	5.050	7.658E 07
1.E4-1.E5	6.267	7.570E 08
1.E5-1.E6	1.167	5.627E 08
1.E6-1.E7	0.0	0.0
1.E7-OVER	0.0	0.0
TOTAL	24.000	1.398E 09

Table 7

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*********************************************************************************************************************************
** ORBITAL FLUX STUDY WITH COMPOSITE PARTICLE ENVIRONMENTS : VETTES AE4, AE5, AP1, AP5, AP6, AP7 **** PROCEDURE : UNIFLUX OF 1972 **
** ELECTRON FLUXES EXPONENTIALLY DECAYED TO 1972. 0 WITH LIFETIMES: E.G.STASSINOPOULOS&P.VERZARIU ** CUTOFF TIMES:               **
** MAGNETIC COORDINATES B AND L COMPUTED BY INVARA OF 1972 WITH ALLMAG, MODEL  5:     IGPF 1965.0 80-TERM 10/68    * TIME= 1972.0 **
** VEHICLE :   TIROS-N 22 ** INCLINATION= 77DEG ** PERIGEE= 1680KM ** APOGEE=  1680KM ** B/L ORBIT TAPE: TD6943 ** PERIOD=  2.000 **
*********************************************************************************************************************************
                                              ************   LOW  ENERGY PROTONS   ************
                                              **************************************************
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****** SPECTRUM IN PERCENT DELTA ENERGY ******

ENERGY RANGES (MEV)	AVERAGED TOTAL FLUX #/CM**2/SEC	AVERAGED TOTAL FLUX #/CM**2/DAY	SPECTRUM PER CENT
.100-.500	1.864E 05	1.611E 10	78.844
.500-.900	1.847E 04	1.596E 09	7.812
.900-1.10	3.132E 03	2.706E 08	1.325
1.10-1.50	3.725E 03	3.219E 08	1.576
1.50-2.00	2.700E 03	2.333E 08	1.142
2.00-2.50	1.882E 03	1.626E 08	0.796
2.50-3.00	1.509E 03	1.303E 08	0.638
3.00-3.50	1.288E 03	1.113E 08	0.545
3.50-OVER	1.731E 04	1.496E 09	7.323
TOTAL	2.364E 05	2.043E 10	100.000

*** COMPOSITE ORBIT SPECTRUM ***

ENERGY LEVELS >(MEV)	AVERAGED INTEG.FLUX #/CM**2/SEC	AVERAGED INTEG.FLUX #/CM**2/DAY
.100	2.364E 05	2.043E 10
.300	7.935E 04	6.856E 09
.500	5.002E 04	4.321E 09
.700	3.759E 04	3.248E 09
.900	3.155E 04	2.726E 09
1.10	2.842E 04	2.455E 09
1.30	2.627E 04	2.270E 09
1.50	2.469E 04	2.133E 09
1.75	2.318E 04	2.003E 09
2.00	2.199E 04	1.900E 09
2.25	2.099E 04	1.813E 09
2.50	2.011E 04	1.737E 09
2.75	1.932E 04	1.669E 09
3.00	1.860E 04	1.607E 09
3.50	1.731E 04	1.496E 09

* EXPOSURE INDEX-ENERGY >.100MEV *

INTENSITY RANGES #/CM**2/SEC	EXPOSURE DURATION (HOURS)	TOTAL # OF ACCUMULATED PARTICLES
ZERO FLUX	4.867	0.0
1.E0-1.E1	0.033	2.582E 02
1.E1-1.E2	0.017	9.849E 02
1.E2-1.E3	0.033	1.724E 04
1.E3-1.E4	1.850	4.381E 07
1.E4-1.E5	8.017	1.202E 09
1.E5-1.E6	7.383	9.116E 09
1.E6-1.E7	1.800	1.007E 10
1.E7-OVER	0.0	0.0
TOTAL	24.000	2.043E 10

Table 8

** ORBITAL FLUX STUDY WITH COMPOSITE PARTICLE ENVIRONMENTS : VETTES AE4, AE5, AP1, AP5, AP6, AP7 **** PROCEDURE : UNIFLUX OF 1972 **
** ELECTRON FLUXES EXPONENTIALLY DECAYED TO 1972. 0 WITH LIFETIMES: E.G.STASSINOPOULOS&P.VERZARIU ** CUTOFF TIMES: **
** MAGNETIC COORDINATES B AND L COMPUTED BY INVARA OF 1972 WITH ALLMAG, MODEL 5: IGRF 1965.0 80-TERM 10/68 * TIME= 1972.0 **
** VEHICLE : TIROS-N 22 ** INCLINATION= 77DEG ** PERIGEE= 1680KM ** APOGEE= 1680KM ** B/L ORBIT TAPE: TD6943 ** PERIOD= 2.000 **

ELECTRONS

** TABLE OF PEAK AND TOTAL FLUXES PER PERIOD - ENERGY >.500 MEV **

PERIOD NUMBER	PEAK FLUX ENCOUNTERED #/CM**2/SEC	POSITION AT WHICH ENCOUNTERED LONGITUDE (DEG)	LATITUDE (DEG)	ALTITUDE (KM)	ORBIT TIME (HOURS)	FIELD(B) (GAUSS)	LINE(L) (E.R.)	TOTAL FLUX PER ORBIT #/CM**2/ORBIT
1	1.267E 07	-55.885	-23.13	1683.50	1.86666	0.12998	1.38	1.187E 10
2	1.004E 07	-52.180	0.22	1680.87	2.00000	0.14721	1.38	6.785E 09
3	6.656E 06	-82.293	0.45	1680.88	4.00000	0.15972	1.36	3.182E 09
4	3.594E 06	-111.981	3.59	1680.96	6.01667	0.16503	1.31	3.208E 09
5	8.253E 06	23.723	-9.79	1675.36	9.05000	0.15543	1.41	5.192E 09
6	1.128E 07	-6.389	-10.01	1675.37	11.05000	0.14001	1.39	7.865E 09
7	1.319E 07	-35.081	-19.00	1676.91	13.10000	0.12928	1.40	9.536E 09
8	1.196E 07	-64.112	-25.05	1678.41	15.13333	0.13394	1.38	8.458E 09
9	8.083E 06	-94.213	-25.27	1678.46	17.13332	0.15482	1.37	5.513E 09
10	7.344E 06	35.086	-9.46	1681.48	19.93330	0.16042	1.40	5.020E 09
11	1.056E 07	4.974	-9.23	1681.47	21.93330	0.14550	1.40	6.235E 09
12	1.278E 07	-26.047	-14.85	1682.18	23.89999	0.13113	1.39	9.759E 09

Table 9

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**********************************************************************************************************************
** ORBITAL FLUX STUDY WITH COMPOSITE PARTICLE ENVIRONMENTS : VETTES AE4, AE5, AP1, AP5, AP6, AP7 **** PROCEDURE : UNIFLUX OF 1972 **
** ELECTRON FLUXES EXPONENTIALLY DECAYED TO 1972. 0 WITH LIFETIMES: E.G.STASSINOPOULOS&P.VERZARIU ** CUTOFF TIMES:                **
** MAGNETIC COORDINATES B AND L COMPUTED BY INVARA OF 1972 WITH ALLMAG. MODEL  5:    IGRF 1965.0 80-TERM 10/68   * TIME= 1972.0 **
** VEHICLE :   TIROS-N 22 ** INCLINATION= 77DEG ** PERIGEE= 1680KM ** APOGEE=  1680KM ** B/L ORBIT TAPE: TD6943 ** PERIOD=  2.000 **
**********************************************************************************************************************
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******************** HIGH ENERGY PROTONS ********************

** TABLE OF PEAK AND TOTAL FLUXES PER PERIOD - ENERGY >5.00 MEV **

PERIOD NUMBER	PEAK FLUX ENCOUNTERED #/CM**2/SEC	POSITION AT WHICH ENCOUNTERED LONGITUDE (DEG)	LATITUDE (DEG)	ALTITUDE (KM)	ORBIT TIME (HOURS)	FIELD(B) (GAUSS)	LINE(L) (E.R.)	TOTAL FLUX PER ORBIT #/CM**2/ORBIT
1	1.624E 05	-55.354	-20.21	1682.91	1.88333	0.12909	1.36	1.847E 08
2	9.981E 04	-84.482	-14.16	1681.91	3.91667	0.14224	1.30	9.491E 07
3	4.756E 04	-115.068	-16.85	1682.34	5.90000	0.15949	1.30	4.580E 07
4	3.762E 04	-111.981	3.59	1680.96	6.01667	0.16503	1.31	5.148E 07
5	7.489E 04	26.194	-24.38	1678.26	9.13333	0.16479	1.78	8.786E 07
6	1.143E 05	-6.389	-10.01	1675.37	11.05000	0.14001	1.39	1.425E 08
7	1.737E 05	-35.081	-19.00	1676.91	13.10000	0.12928	1.40	1.794E 08
8	1.410E 05	-65.188	-19.22	1676.95	15.10000	0.13252	1.34	1.380E 08
9	7.461E 04	-95.791	-16.53	1676.37	17.08331	0.14850	1.30	8.088E 07
10	6.865E 04	32.056	-26.94	1684.52	19.83331	0.17007	1.88	8.105E 07
11	1.052E 05	1.338	-29.62	1685.19	21.81667	0.15337	1.84	1.213E 08
12	1.609E 05	-26.530	-17.76	1682.65	23.88332	0.13153	1.42	1.899E 08

Table 10

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*****************************************************************************************************************
** ORBITAL FLUX STUDY WITH COMPOSITE PARTICLE ENVIRONMENTS : VETTES AE4, AE5, AP1, AP5, AP6, AP7 **** PROCEDURE : UNIFLUX OF 1972 **
** ELECTRON FLUXES EXPONENTIALLY DECAYED TO 1972. 0 WITH LIFETIMES: E.G.STASSINOPOULOS&P.VERZARIU ** CUTOFF TIMES:            **
** MAGNETIC COORDINATES B AND L COMPUTED BY INVARA OF 1972 WITH ALLMAG, MODEL  5:     IGRF 1965.0 80-TERM 10/68     * TIME= 1972.0 **
** VEHICLE :   TIROS-N 22 ** INCLINATION= 77DEG ** PERIGEE= 1680KM ** APOGEE=  1680KM ** B/L ORBIT TAPE: TD6943 ** PERIOD=  2.000 **
*****************************************************************************************************************
                    ********************    LOW  ENERGY PROTONS   ********************
                    ** TABLE OF PEAK AND TOTAL FLUXES PER PERIOD - ENERGY >.100 MEV **
                    ******************************************************************
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PERIOD NUMBER	PEAK FLUX ENCOUNTERED #/CM**2/SEC	POSITION AT WHICH ENCOUNTERED LONGITUDE (DEG)	LATITUDE (DEG)	ALTITUDE (KM)	ORBIT TIME (HOURS)	FIELD(B) (GAUSS)	LINE(L) (E.R.)	TOTAL FLUX PER ORBIT #/CM**2/ORBIT
1	2.029E 06	-5.785	57.55	1692.64	0.33333	0.25657	4.36	1.489E 09
2	1.519E 06	-39.398	52.24	1691.28	2.30000	0.26162	4.70	1.153E 09
3	1.258E 06	-72.158	46.83	1689.79	4.26667	0.27614	4.70	9.342E 08
4	2.054E 06	64.092	-50.04	1686.94	7.28333	0.24236	4.50	1.157E 09
5	2.709E 06	37.311	-55.82	1689.02	9.31667	0.21486	4.51	1.616E 09
6	3.472E 06	11.867	-61.44	1690.94	11.35000	0.20729	4.34	1.846E 09
7	3.330E 06	-11.352	-66.76	1692.61	13.38333	0.21341	4.29	1.745E 09
8	2.264E 06	-30.723	-71.56	1693.97	15.41667	0.22729	4.65	1.547E 09
9	2.602E 06	-60.366	-71.72	1694.02	17.41664	0.23581	4.29	1.810E 09
10	2.990E 06	-19.694	-58.19	1692.93	19.64999	0.20419	4.17	2.704E 09
11	2.694E 06	-23.099	-68.30	1694.98	21.58331	0.21671	4.19	2.609E 09
12	2.128E 06	-64.539	-72.54	1695.55	23.54999	0.23997	4.48	1.817E 09

TABLE _

TIROS-N 22

CIRCULAR

INCLINATION: 77 DEG

PERIGEE: 1680 KM

APOGEE: 1680 KM

DECAY DATE: 1972. 0.

**** EXPOSURE ANALYSIS ****

	PROTONS-LOW (E>.100MEV)	PROTONS-HIGH (E>5.00MEV)	ELECTRONS (E>.500MEV)
PERCENT OF TOTAL LIFE-TIME SPENT IN FLUX-FREE REGIONS* OF SPACE :	20.28 %	37.85 %	16.18 %
PERCENT OF TOTAL LIFE-TIME SPENT IN HIGH-INTENSITY REGIONS+ OF VAN ALLEN BELTS :	79.37 %	52.01 %	49.72 %
PERCENT OF TOTAL DAILY FLUX ACCUMULATED IN HIGH-INTENSITY REGIONS:	100.00 %	99.88 %	99.03 %

****

* <1 PARTICLE/CM**2/SEC

+ >1.E5 EL/CM**2/SEC OR 1.E3 PR/CM**2/SEC

TABLE 44

TIROS-N 22

CIRCULAR

INCLINATION: 77 DEG

PERIGEE: 1680 KM

APOGEE: 1680 KM

DECAY DATE: 1972. 0.

* PERCENT OF TOTAL LIFETIME SPENT INSIDE AND *
* OUTSIDE THE TRAPPED-PARTICLE RADIATION BELT *

INNER ZONE -TI-* (1.0 < L < 2.5)	:	51.81 %
OUTER ZONE -TO- (2.5 < L < 7.0)	:	26.81 %
EXTERNAL -TE- (L > 7.0)	:	21.39 %
TOTAL	:	100.00 %

*TIME IN INNER ZONE MAY BE SUBDIVIDED AS FOLLOWS:

OUTSIDE TRAPPING REGION (1.0 < L < 1.1)	:	0.0 %
INSIDE TRAPPING REGION (1.1 < L < 2.5)	:	51.81 %

TABLE ARRANGEMENT

Computer Produced Output Tables for Orbital Flux Integrations.

Standard Production Runs with UNIFLUX Program.

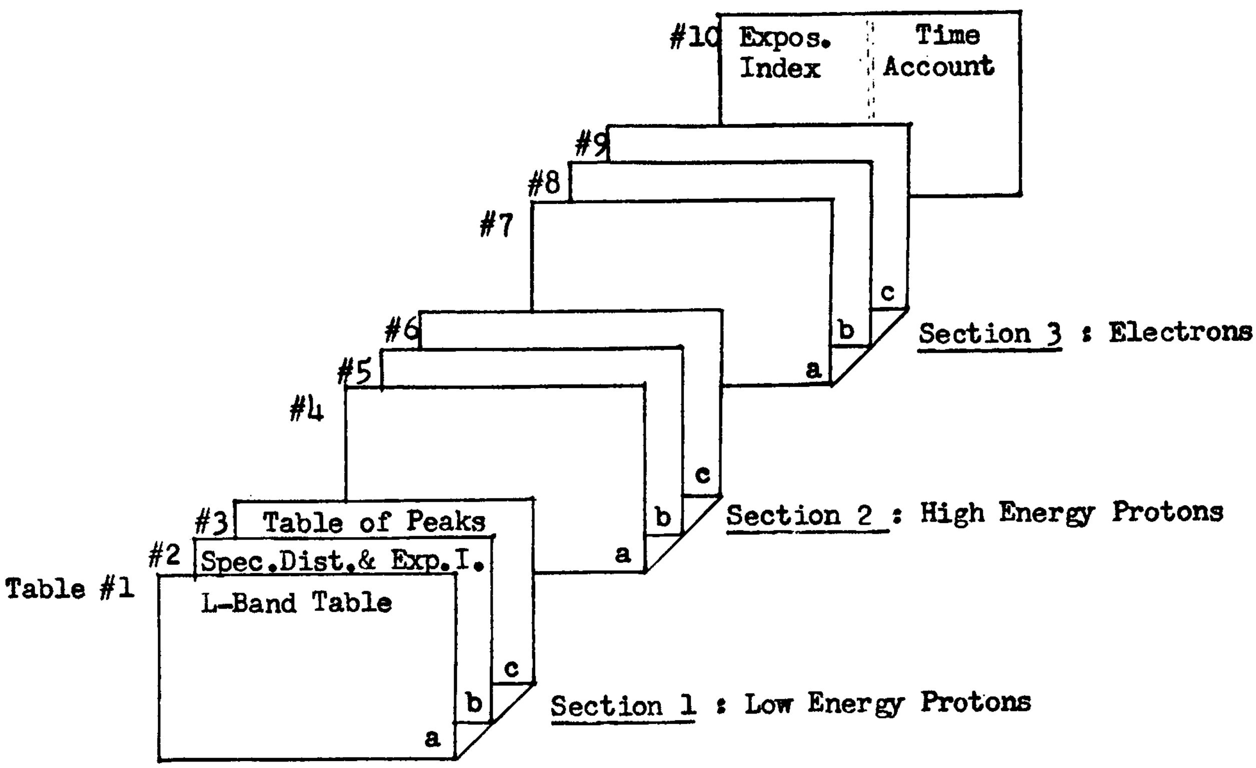


Figure 1 : Set of tables produced for every trajectory considered in a trapped particle radiation study.

PLOT ARRANGEMENT

Computer Produced Plots for Orbital Flux Integrations.

Standard Production Runs with UNIFLUX Program.

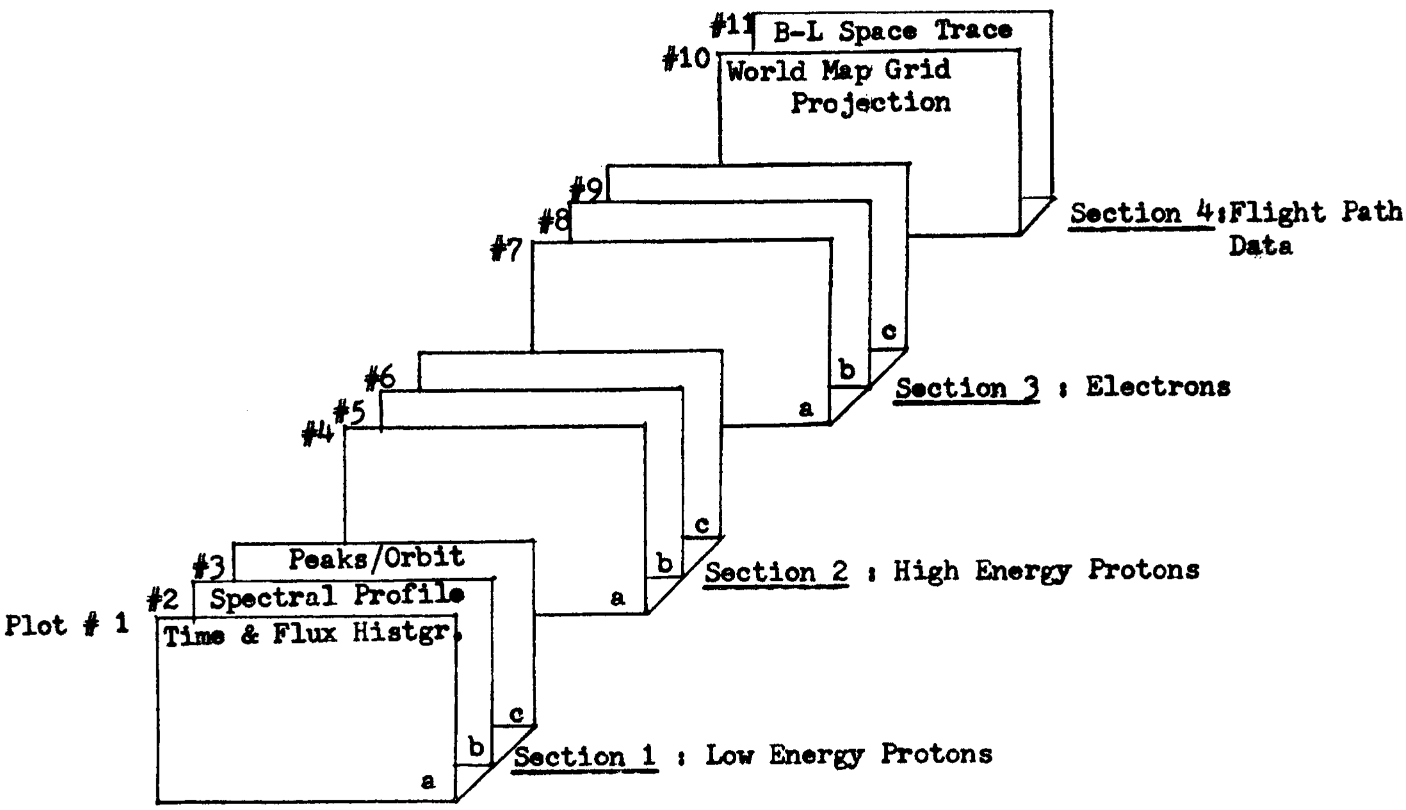


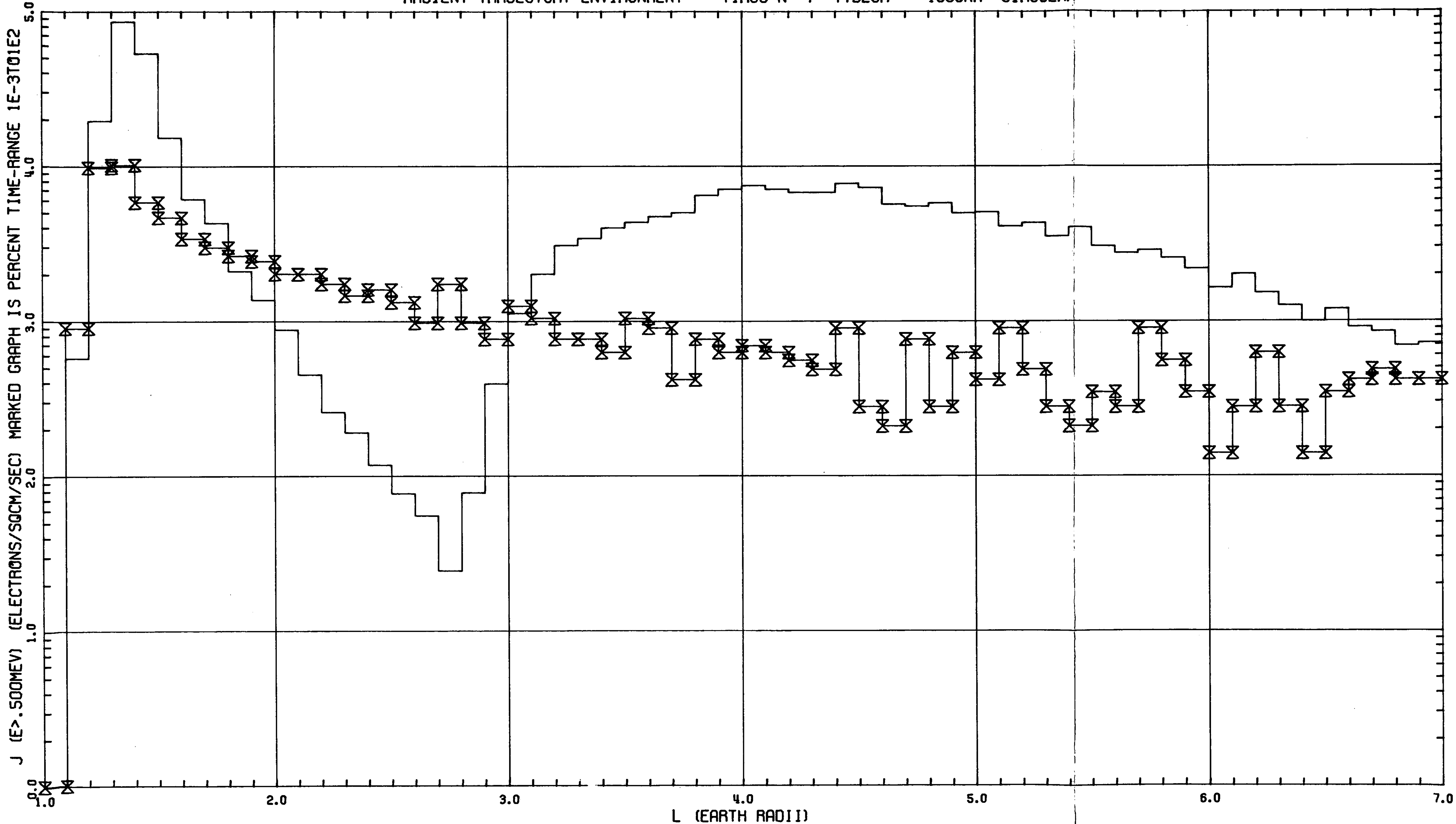
Figure 1a : Set of plots produced for every trajectory considered in a trapped particle radiation study.

FOLDOUT FRAME 1

FOLDOUT FRAME 2

Figure 2

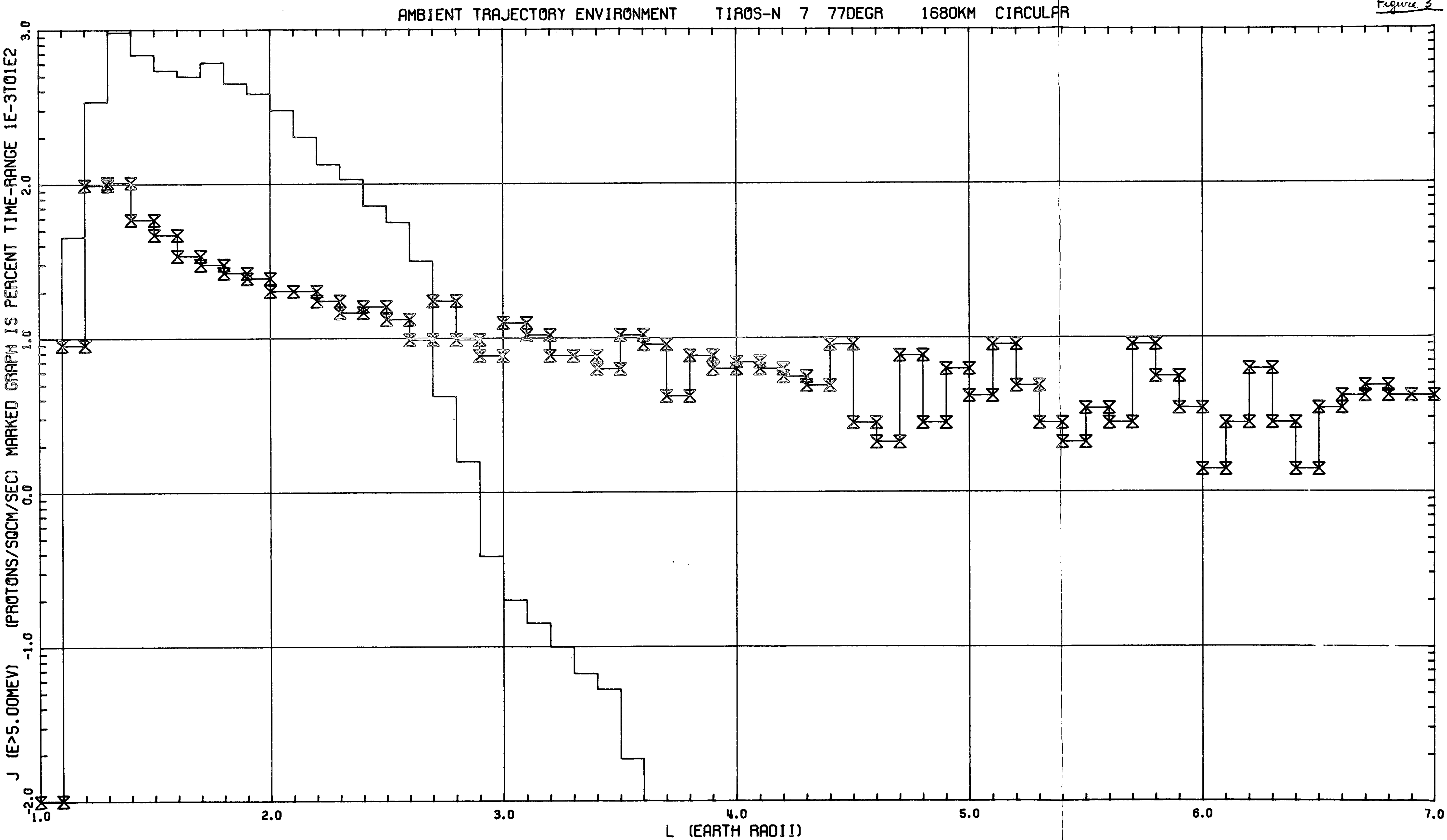
AMBIENT TRAJECTORY ENVIRONMENT TIROS-N 7 77DEGR 1680KM CIRCULAR



FOLDOUT FRAME 1

FOLDOUT FRAME 2

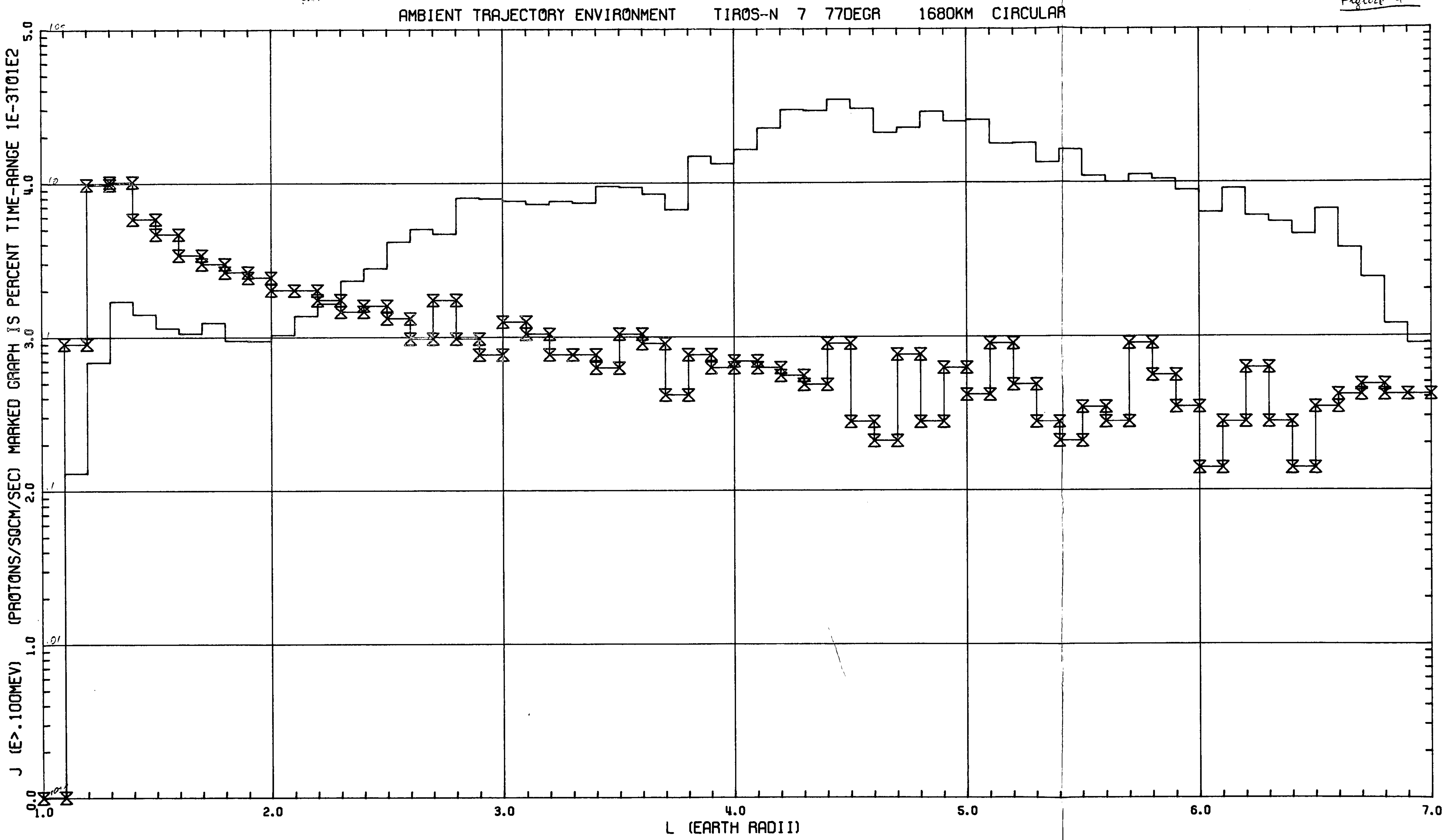
Figure 3



FOLDOUT FRAME 1

FOLDOUT FRAME 2

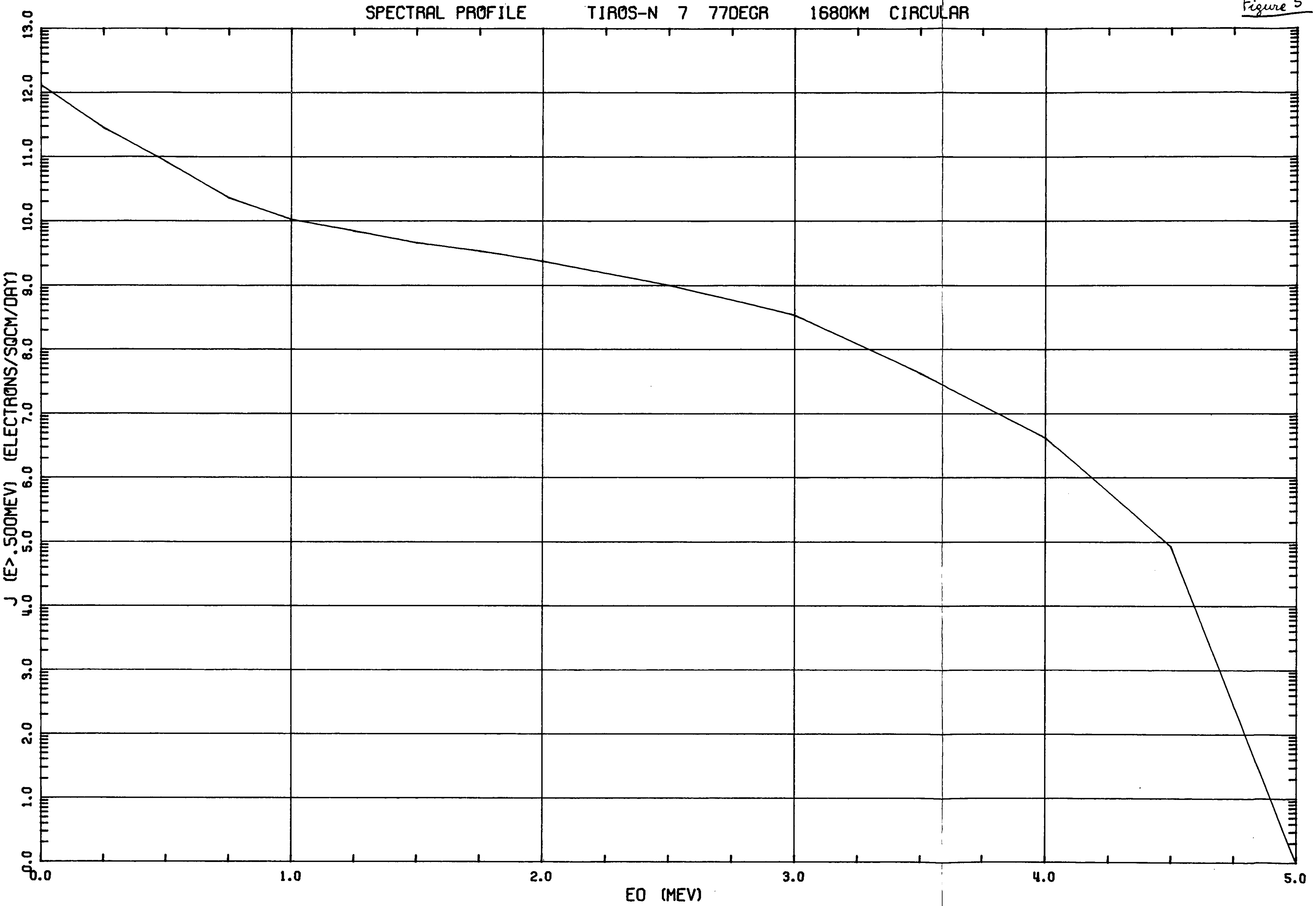
Figure 4



FOLDOUT FRAME 1

FOLDOUT FRAME 2

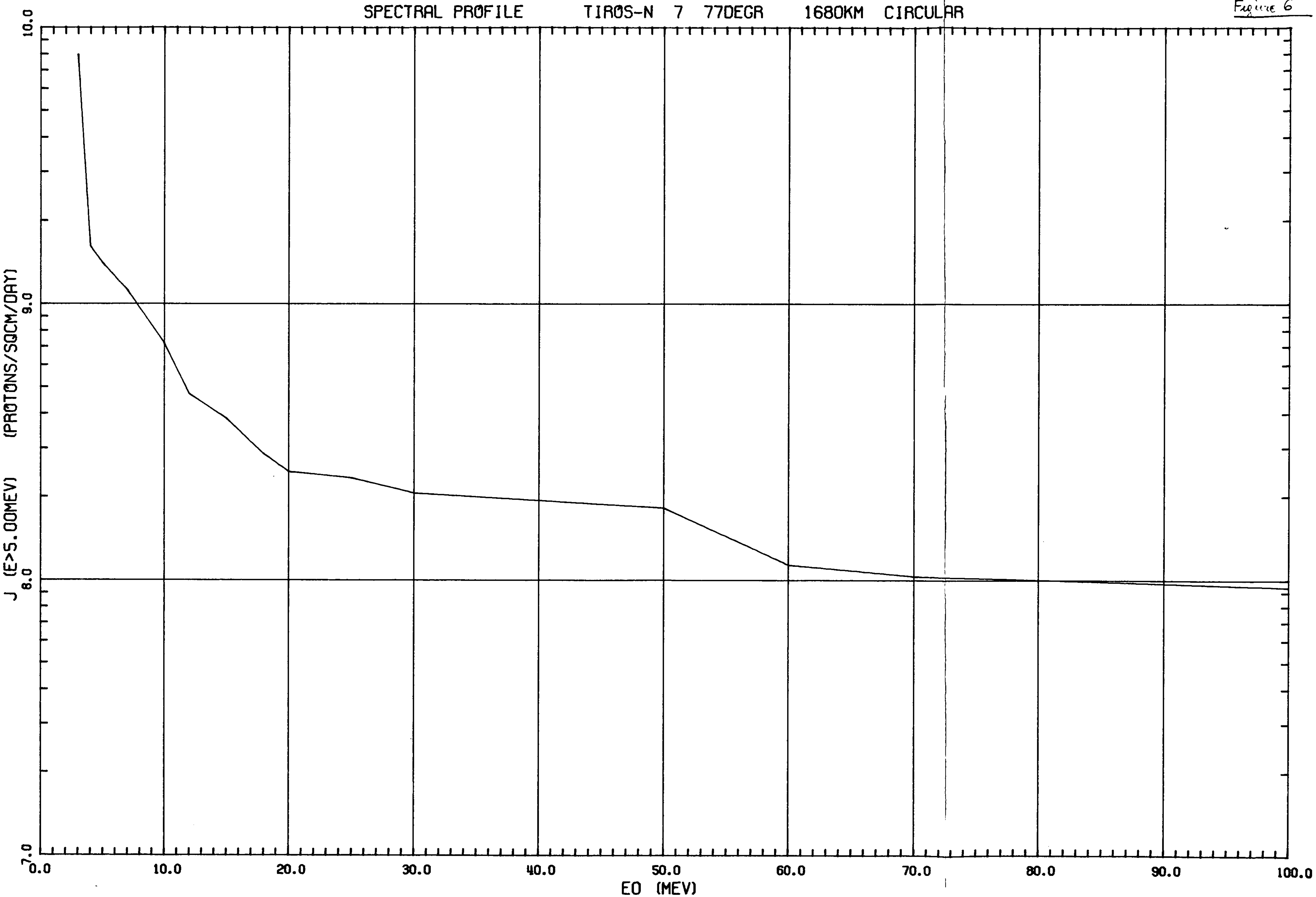
Figure 5



FOLDOUT FRAME 1

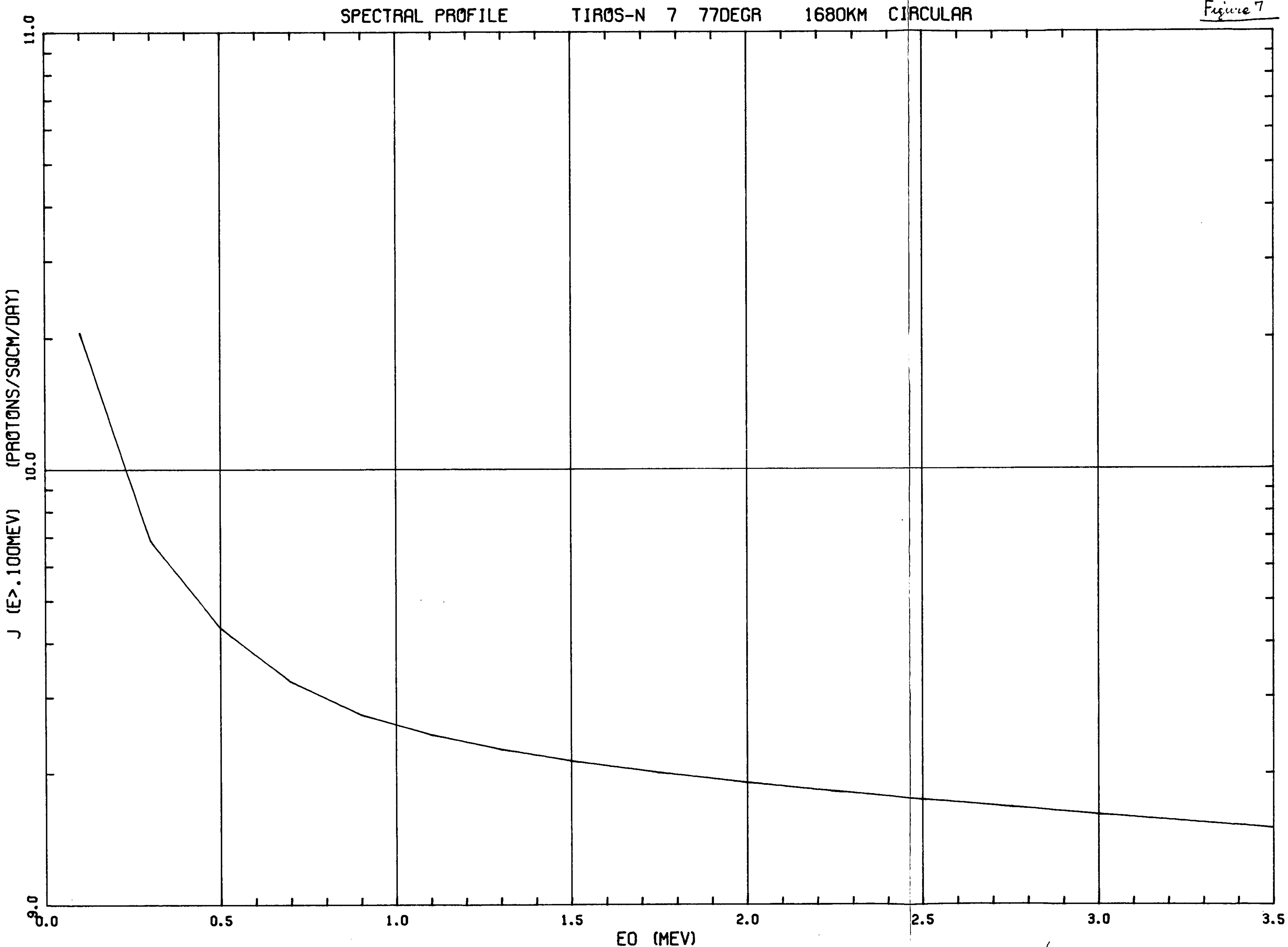
FOLDOUT FRAME 2

Figure 6



FOLDOUT FRAME 1 FOLDOUT FRAME 2

Figure 7



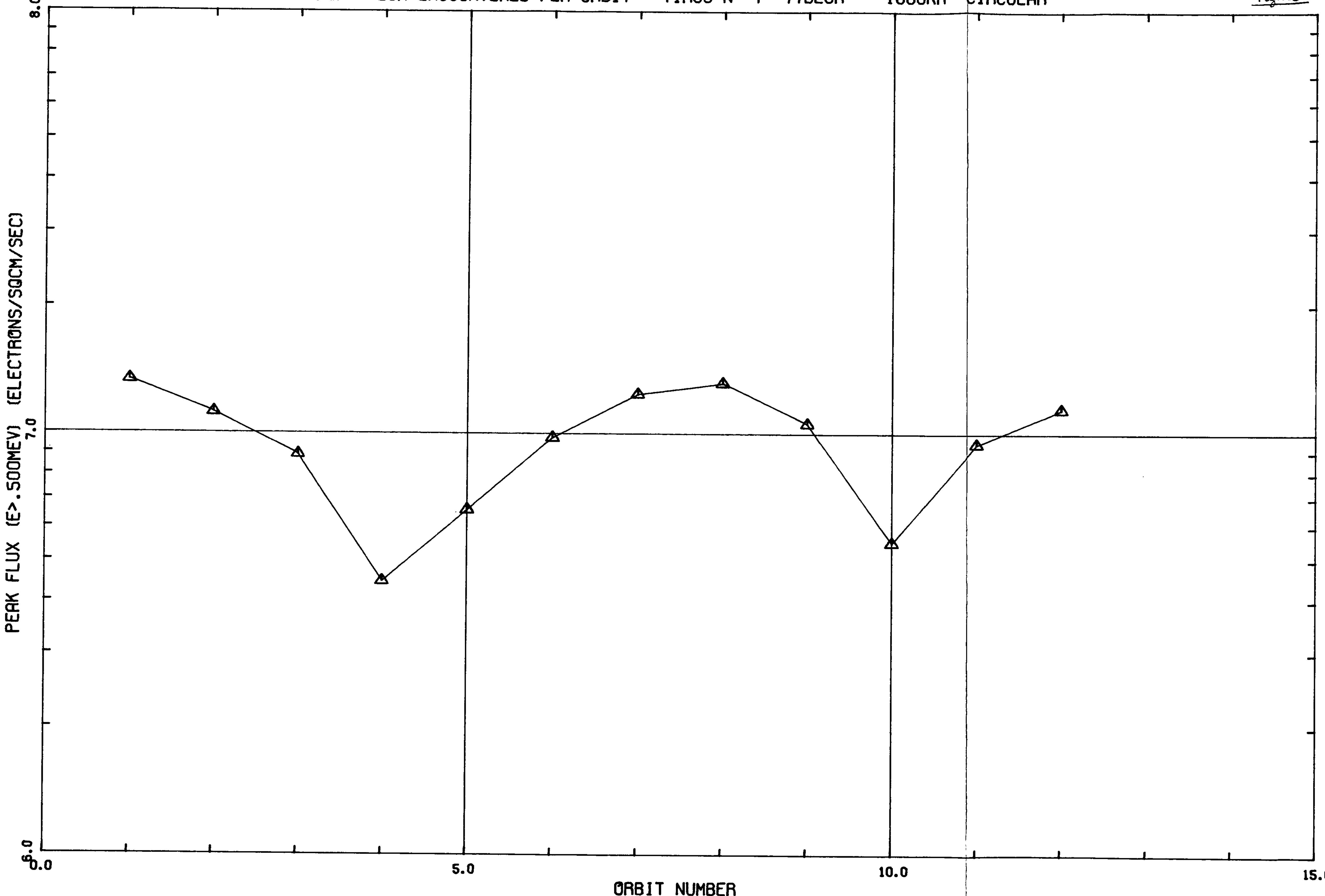
4

FOLDOUT FRAME 1

FOLDOUT FRAME 2

Figure 8

PEAK FLUX ENCOUNTERED PER ORBIT TIROS-N 7 77DEGR 1680KM CIRCULAR

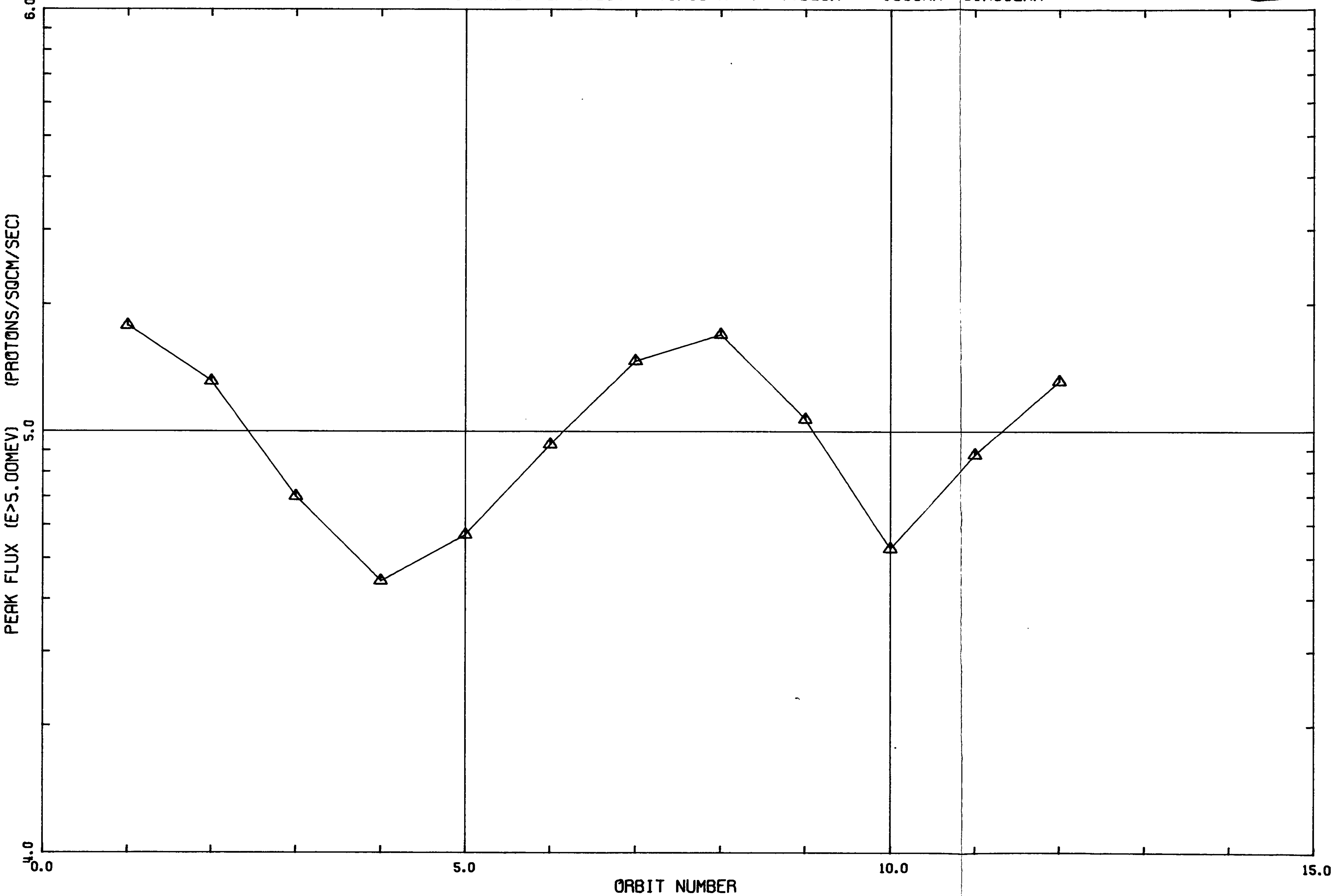


FOLDOUT FRAME 1

FOLDOUT FRAME 2

PEAK FLUX ENCOUNTERED PER ORBIT TIROS-N 7 77DEGR 1680KM CIRCULAR

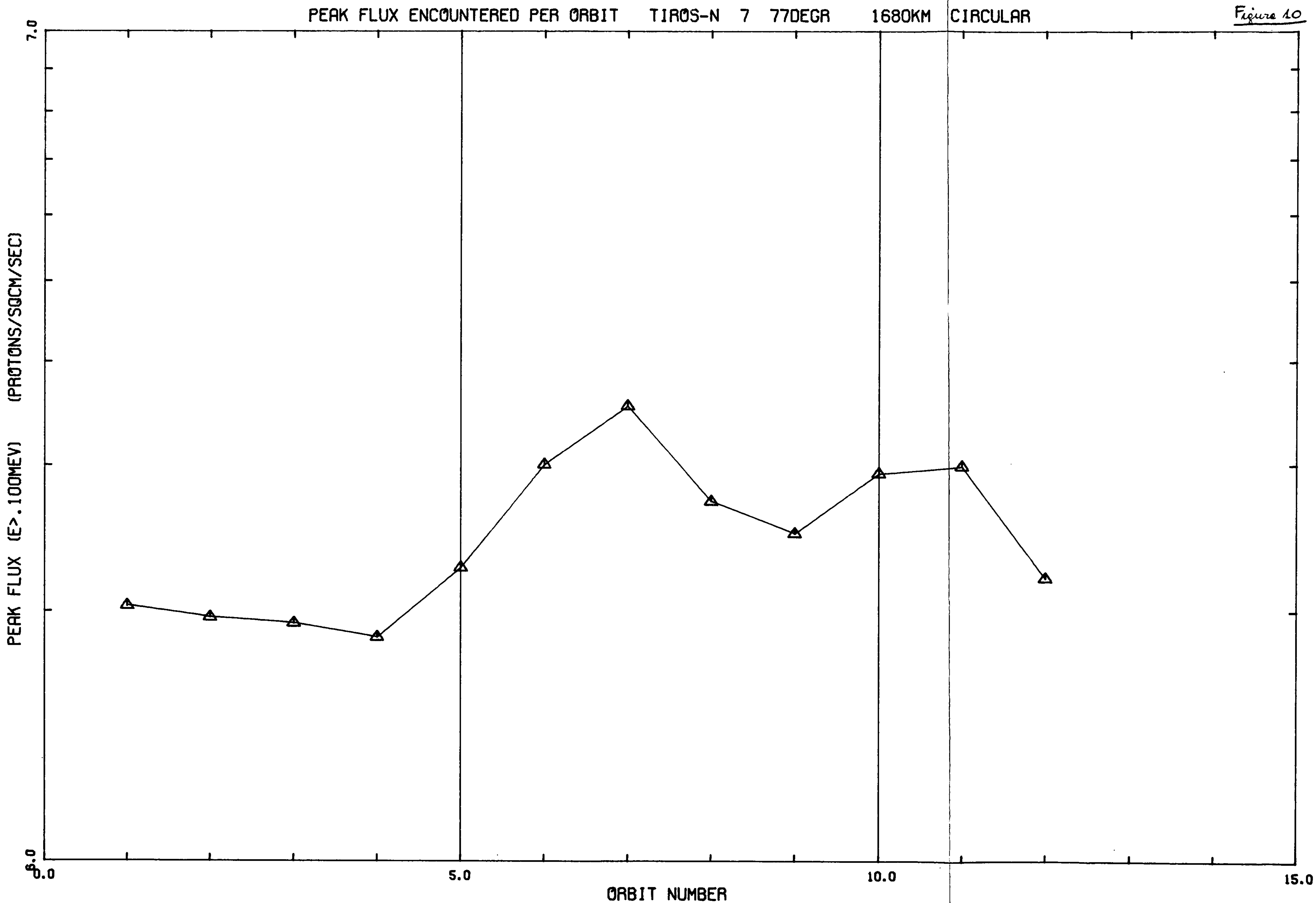
Figure 9



FOLDOUT FRAME 1

FOLDOUT FRAME 2

Figure 10

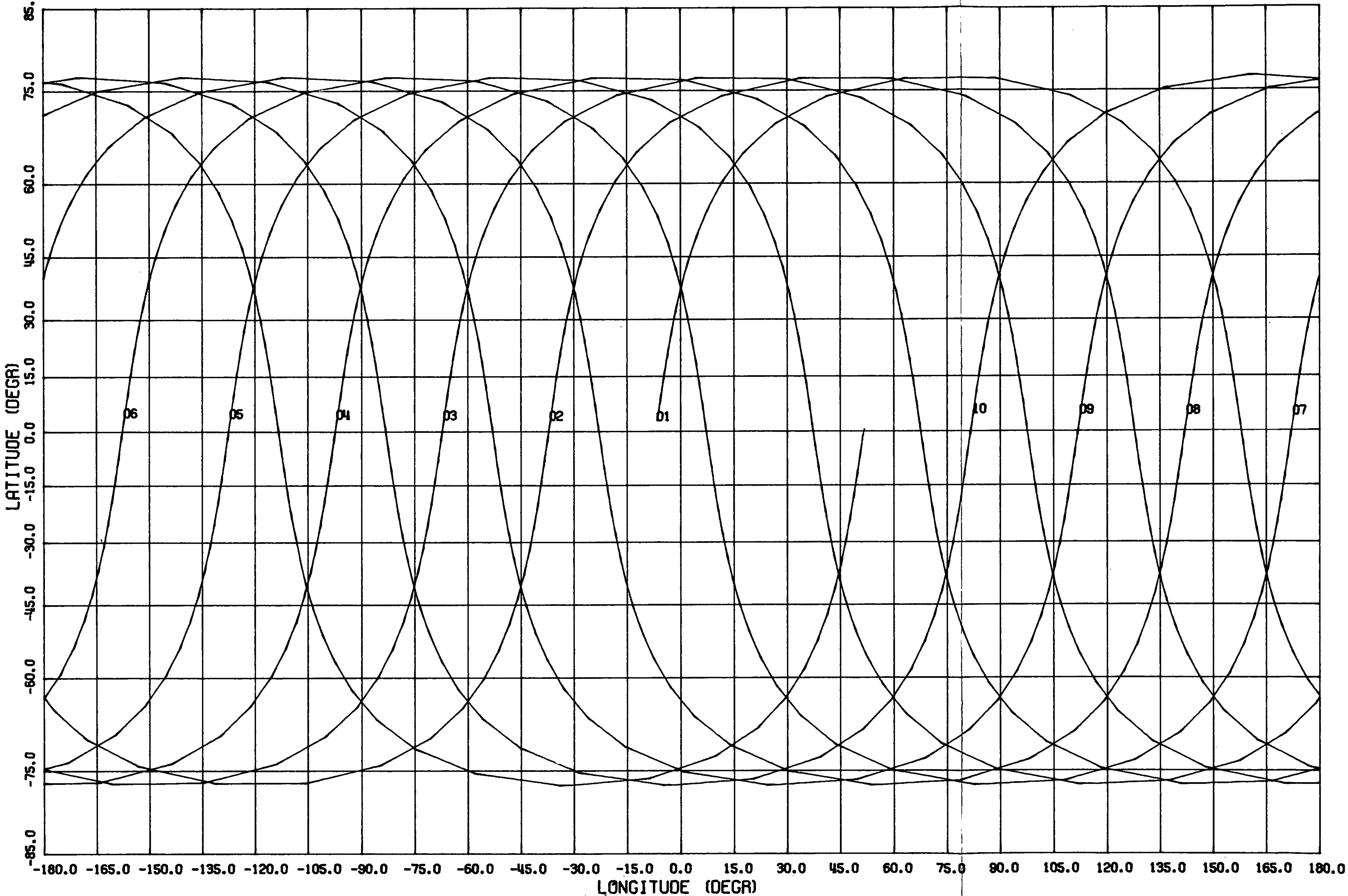


FOLDOUT FRAME 1

FOLDOUT FRAME 2

Figure 11

TIROS-N 7 77DEGR 1680KM CIRCULAR



FOLDOUT FRAME 1

FOLDOUT FRAME 2

Figure 12

TIROS-N 7 77DEGR 1680KM CIRCULAR

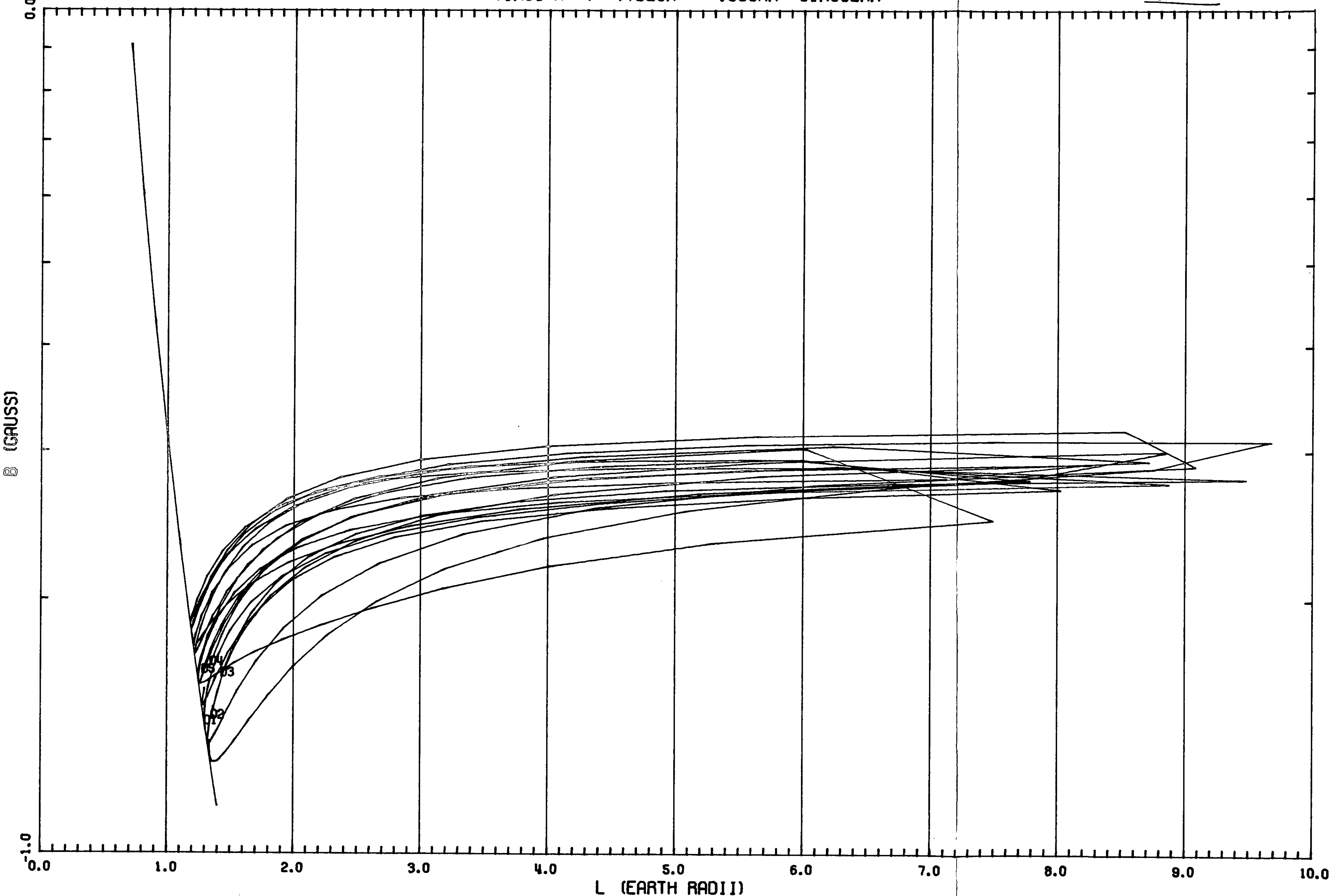
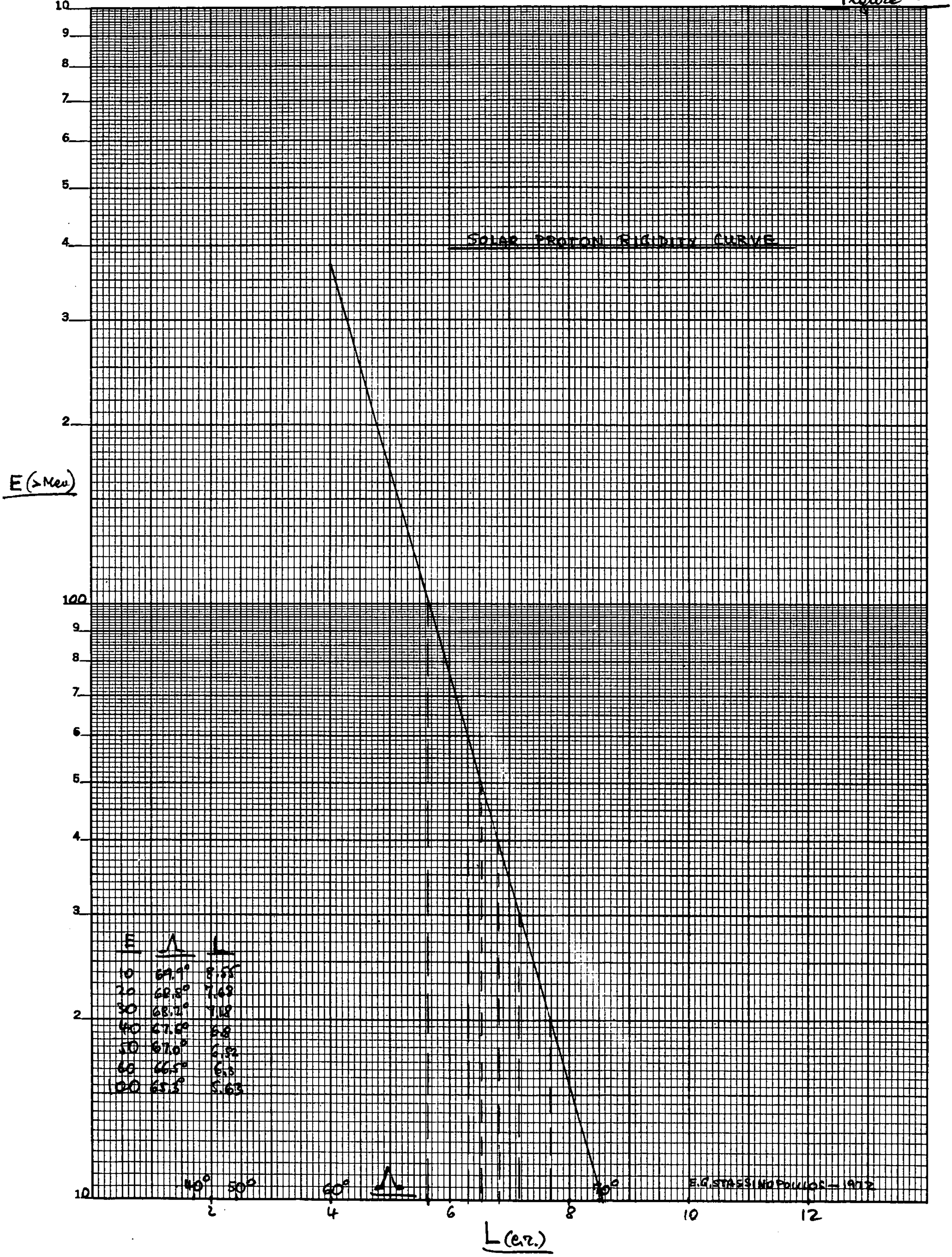
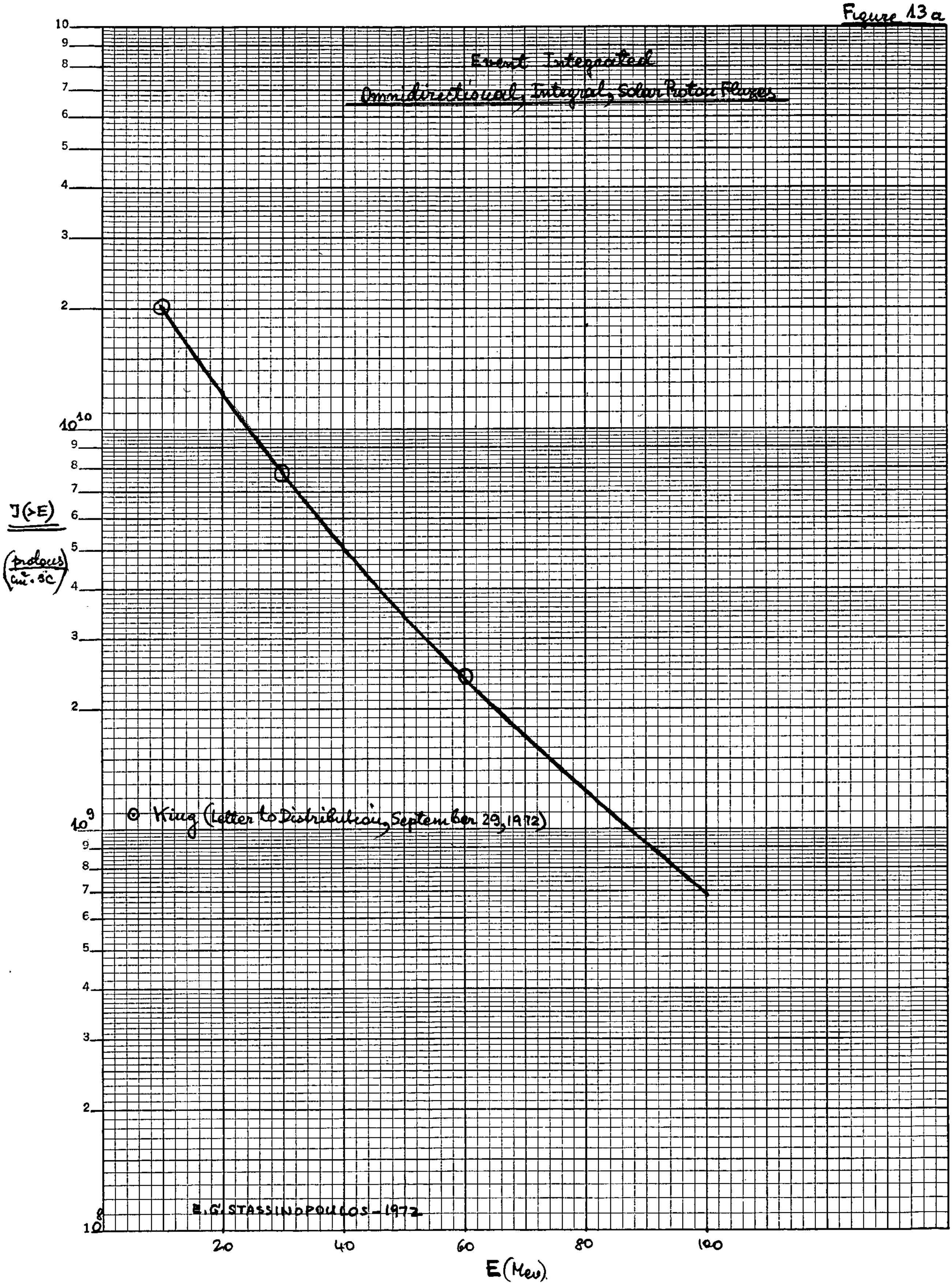


Figure 13



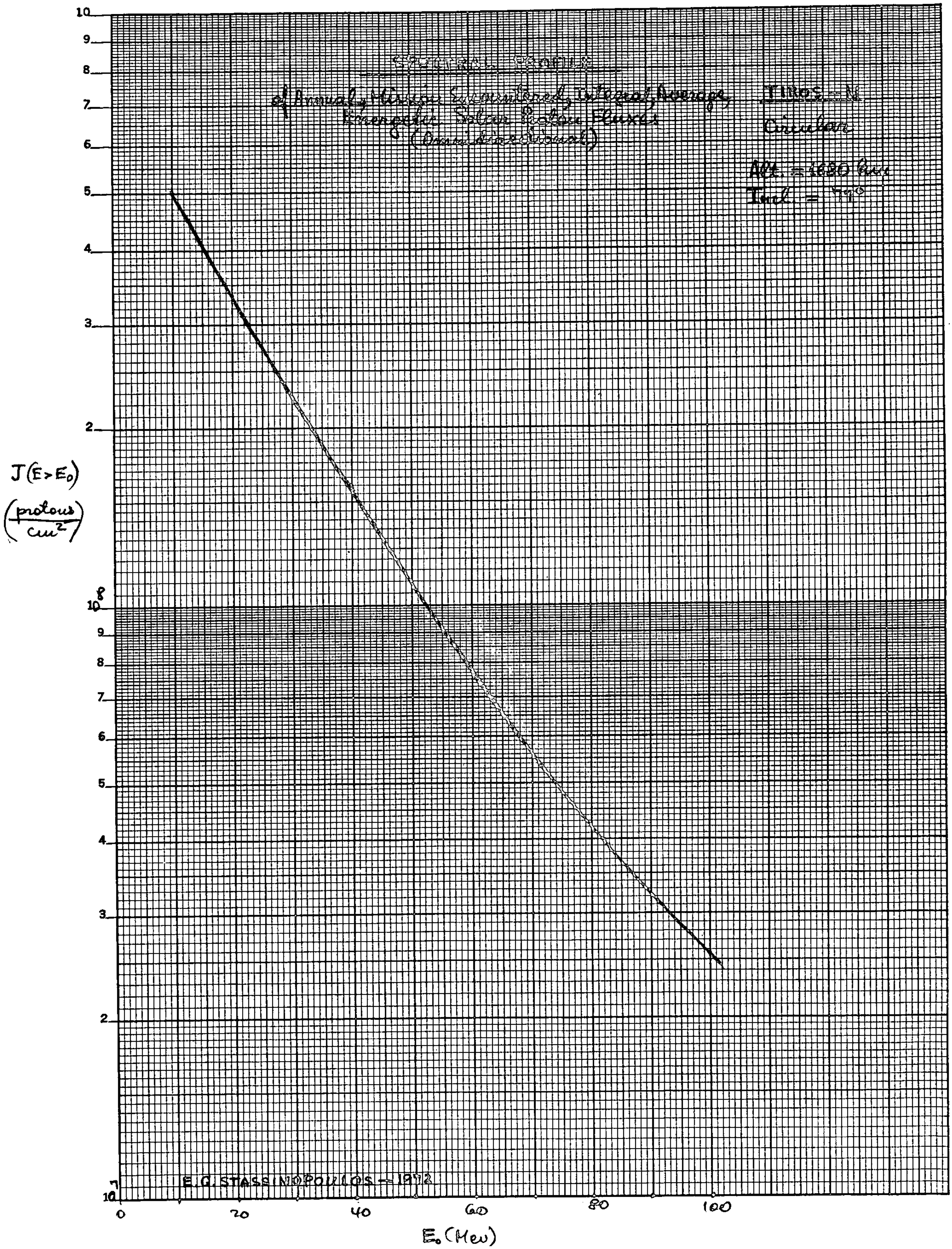
SOLAR PROTON RIGIDITY CURVE
E (>Mev)
L (e.r.)
E Λ L
10 69.9° 8.55
20 68.8° 7.68
30 68.2° 7.18
40 67.6° 6.8
50 67.0° 6.52
60 66.5° 6.3
100 65.5° 5.63
40° 50° 60° Λ 70°
E.G. STASSINOPOULOS — 1972

Figure 13a



Event Integrated
Omnidirectional, Integral, Solar Proton Fluxes
J(>E)
(protons/cm².sec)
10^{10}
10^9
10^8
20
40
60
80
100
E(Mev)
⊙ King (Letter to Distribution, September 29, 1972)
E.G. STASSINOPOULOS - 1972

Figure 14



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